ELECTRICAL REVIEW

ILLUSTRATED.

A WEEKLY JOURNAL OF

Electric Light, Power, Telephone, Telegraph and Scientific Progress.

VOL. 21. No. 25. WEEKLY.

NEW YORK, SATURDAY, FEBRUARY 11, 1893.

$3 per Annum. Single Copies, 10 Cents.

Copyright, 1893, by ELECTRICAL REVIEW PUBLISHING COMPANY, 13 Park Row, New York.

Entered at Post Office, New York, as Mail Matter of the Second Class.

VIEWS, NEWS AND INTERVIEWS.

Electric train-lighting apparatus is being introduced into some of the railroads of France. Six, eight and ten candle-power lamps are used, according to the class of the compartment. The storage system is used. Each car carries its own independent battery of 16 cells, arranged in a car in such a way as to be readily accessible. All connections are made outside of the car.

"Yes, sir!" exclaimed the eminently respectable old doctor, whose superior knowledge every one present bowed down to. "I can always manage to recognize the voice of the person at the other end of the 'phone." Suddenly the telephone bell rang, and that individual jumped up with a "just watch me" air and answered the ring. After saying "hello," in his most polite voice, his face all of a sudden became crimson, and, with a muttered ——, he jammed the receiver on the hook with such emphasis that nearly every one in the office thought he had broken the connections.

"What's the matter, doctor, didn't you recognize the voice?"

"No, I didn't, but I'd like to catch the man that rang that bell. Some idiot told me to shut up my blamed head."

The bell rang again and the mystery was solved. The man at the other end had been talking to a dog in his office, that had set up barking, and the remark was intended for his dogship and not for the man of science.

The Edison Electric Lamp Works, in Harrison, N. J., have appealed for police protection because of the fights between girls who are struggling for admission in search of work. Girls are being employed at the rate of 20 a day.

"I would suggest that there is a field of invention largely unexplored," said Manager of Transportation Baker, of the National Electric Light Association, "relating to the comfort and gratification of travelers. If some method of connection between the wheels and the body of the car, by means of special gearing, could be invented by which a gentle revolving movement could be obtained, alternating the passenger from sunshine to shade, and from shade to sunshine, it would be a great help to me in giving satisfaction to passengers to electric light conventions. Then, the requests for staterooms and lower berths are so unanimous that, should any one write for an upper berth, I would not answer for the consequences to both Secretary Porter and myself, as startling surprises of this nature often develop heart disease. I leave it to the inventor to suggest a way to make lower berths out of upper ones, and when he does I am his friend forever."

Over fifty wires owned by the American Telegraph and Telephone Company cross the town of Huntington, Conn. Last week this line was almost completely demolished at the place where it crosses the road between Shelton and Huntington Center. Henry Boylan, a contractor who has been busy blasting in that locality, loaded up a good healthy blast and proceeded to light it. He stood off at a safe distance to watch the outcome, and was much surprised to see that enough rock was ejected to cut fifty of the fifty-five wires. But the telephone people were much more surprised. Linemen were quickly sent to the spot, and it was not long before the breaks were repaired. Now the Long Distance Telephone Company have attached Boylan's property to the extent of $5,000, and are awaiting developments.

FIG. 2.—ELECTRIC CHAFING DISH.

Bolossy Kiralfy has been at work for several weeks supervising a large corps of designers and artists who have been preparing decorations for the coming Arion Ball, to take place on February 18, in the Madison Square Garden. There will be in all over 5,500 electric lights. On the ground floor there will be a dozen tremendous columns, four feet thick and 35 feet high, each one surmounted by a big electric sun six feet in diameter. Encircling each column will be a spiral garland containing 200 electric lights. Twenty smaller columns, each a foot thick, covered with bronze and nickel, will uphold an equal number of huge globes, within which will be placed 200 electric lights, and strung from the columns will be a wire 850 feet long, extending all around the building, holding thousands of pendant crystal prisms. No doubt the effect will be magnificent.

FIG. 1.—CARPENTER ELECTRIC HEATING SYSTEM.—ELECTRIC OVEN, SHOWING SWITCH, THERMOMETER AND LINE CONNECTIONS.—(See next page.)

An Ingenious Electric Signal.

Constantly increasing installations of electric light and power plants in London make it necessary to open up connections with the street mains, and the usual tent-covers under which the workingmen carry on their operations are sometimes difficult to see on the numerous foggy days. In order, therefore, to warn pedestrians and the drivers of vehicles, a simple arrangement has been devised of ordinary small iron gas tubes set upright at each end, and containing two wires. These wires connect with the main line and current is obtained to light a ruby colored incandescent lamp which is fixed at the top of each standard. The entire apparatus is light and its portability recommends it.

A very large demand for Lake copper for electrical purposes in the spring is predicted.

Non-Magnetizable.

PROSPECT HEIGHTS—Don't you find that the trolley cars affect your watch?

PARKLEY FRONTER—No; I haven't noticed it.

PROSPECT HEIGHTS—That's strange; how do you account for it?

PARKLEY FRONTER—Well, you see, I only carry the ticket.—*Life.*

LIGHT AND POWER STATIONS.

SOME HINTS TO OWNERS AND OPERATORS BY A PRACTICAL ENGINEER.

Pole and Line Construction—Underground Construction Strongly Advocated—Experience Shows It To Be the Best—Straight Lines Preferable.

BY ROBB MACKIE.

XIII.

Having disposed of the chief questions pertaining to the location and construction of the station, the next subject to be considered is the means to be adopted for the transmission of the energy developed by the boilers, engines and dynamos contained therein to the work it has to do; and it will be found that not the least element to be considered in the make-up of the plant is that of pole and line construction.

In the majority of cases the subject of underground construction can be put aside on the plea that "it is not a necessary condition, and therefore too expensive;" and while I do not altogether accept this plea, but am tempted to advocate nothing but underground construction, on the basis that it is the best and, therefore, in the end, the cheapest, and the system that will eventually be adopted in all large cities, I at present yield the point for the sake of dealing with the all-important question of overhead construction.

This conclusion that underground construction is the best has been forced upon me little by little by my experience in the examination of lines now up and in use by a number of companies. An absolute condition necessary for the operation of underground circuits is that the work on them shall be well done, for if it is not there will be so much "trouble" on them, as a constant attendant upon their operation, that the owners will quickly take the necessary steps to put the entire system in the very best of shape in order to operate without interruption. On the other hand, it really seems as though many station managers and operators consider a poorly built, flimsy and dilapidated line as a necessary condition to overhead construction. They throw their work together on the basis that "anything will do now just to get this consumer going, and we will come back tomorrow and shape it all up."

This later trip is never made, and as a result the lines get into worse and worse condition as the months go by. Entirely eliminating the fact, previously dwelt upon at length, that the danger of fire and accidental death are vastly increased by this temporary work, let us consider before taking up the work in detail, the effects of such conditions upon the earning capacity of the plant.

It is a well recognized fact that construction of this character results in constant "crosses," "grounds" and other "trouble," which necessitates repeated shutting down of the circuit. Take, for example, an arc light circuit operating 45 lights burning "from dusk to midnight every week night."

Ten dollars per month each is not a high or an unusual price to charge for such service; this would make the service pay $450 per month, or, on the basis of an average of 26 days of five hours burning, the return from the circuit would be at the rate of about $3.50 per hour of lighting. When "trouble shows up" on such a circuit, it generally means the shutting down for a couple of hours at least, and often for the entire evening, with the result that not only is the usual expense of operating going on, but the income from these lights is lost, while the expense of the linemen, who are kept

FIG. 3.—ELECTRIC DISC HEATER—WITH SWITCH.

"hunting the trouble" until it is found, must be added to the actual loss of revenue. As it generally happens that two circuits get foul of one another, it is safe to count that the company is out of pocket from $5 to $10 per hour in actual cash, without considering the proportion of "fixed charges" for the time that even one comparatively unimportant circuit is inoperative, which should be added to arrive at the correct loss. That such loss would increase at a very much larger ratio, in case the circuit was one for the supply of incandescent lights or power, can quickly be realized by the latest tyro in this work.

Again, this cheap style of work calls for constant repairs and renewal, and such items, while comparatively insignificant in themselves, mount up to a goodly sum at the end of a twelvemonth.

Before commencing the construction of a pole line it is always best to select the streets upon which the main lines and branches are to be erected, and to carefully plan out the entire arrangement of poles both for present and prospective needs as far as possible in advance. In doing this great care should be taken to avoid as far as possible the streets which have shade trees on them or which are already occupied by the poles and lines of other companies. This cannot always be accomplished, and when it cannot, then avoid as far as possible placing two lines of poles on the same side of the street.

In the selection of the streets along which the main lines are to be run care should be taken to have the poles all on one side of the street; that is, crossing and re-crossing in a zig-zag manner should be avoided, and never allowed, except as a last emergency, as such a line cannot be kept in shape without much trouble and constant repairs. The side strains on a pole at a crossing of this kind pulls the pole out of line and give it a very unsightly appearance.

In the selection of a street through which branch lines are to be run, or into which main lines are to be turned, a route should be selected which will allow for the proper placing of corner poles and guy stubs. By the exercise of judgment in this particular a substantial construction can be secured which will keep the line in good condition for years.

In making a contract for poles it should be stipulated that all poles that are not straight will be thrown out and payment refused therefor. If this hint is observed and the inspection made as the poles are unloaded, and the crooked ones thrown out, it will be found to exercise a wonderfully salutory effect upon the contractor and the later shipments will be a much better class of pole. It is not necessary that all poles should be absolutely straight. It is generally allowable that a pole can be curved in one direction to a limited degree, for good pole setters can place these so the crookedness will not show.

All poles should be carefully dressed before they are set, and as soon as possible after they are placed they should be painted thoroughly with two coats of good paint. This will be found to add materially to their appearance and length of life.

Whenever it is possible to do so without using too lofty poles, always cross an existing line of another company by going above it. Should this be impracticable go below it, but never under any circumstances have the wires of two crossing lines interlace each other.

As far as possible use poles of one length throughout, but where there is much difference in the number of wires to be carried on the different lines different lengths can be used, but in such a case establish a minimum height for the lowest cross arms and then put up poles in accordance with this limit.

Cross arms should be of standard size for electric light lines and of good sound material. In placing on the poles the lag bolts should not be driven into place with a hammer, but should be screwed into place. Braces should invariably be used and carefully fastened.

As far as possible all the cross arms on a pole line in a street should be of a uniform length, and invariably those on a pole must all be uniform.

The selection of the wire for a plant must be done with care and judgment, as this is one of the most important elements going to make up the outside construction. There are many makes of wire that are thoroughly satisfactory and reliable for one kind of service that are not at all suitable for another. Owing to the number of grades of wire on the market it is almost impossible to lay down any rule to govern the selection

FIG. 4.—ELECTRIC DISC HEATER—WITHOUT SWITCH.

of the make of wire to be used for any particular work. It is safe, however, to advise against the purchase of the cheap grades of wire of any class. If a rubber covered wire is required, be sure to select two or three of the reliable makes and get quotations on them, and then buy from the most acceptable. Purchase other grades of wire on the same basis. Don't be carried away by the oily tongued salesman, who will try to convince you that the brand of wire which he is selling is "as good an insulation as any on the market," and that the price is "way below the quotations you can get from any other house." The two statements do not harmonize any more than do oil and water mix, for up to the present time it has been found an impractical undertaking to produce a really low priced yet durable and highly insulated wire.

Follow the same course in the purchase of other grades of wire for the entire plant, both for interior and exterior wiring, and while it will be found to be more expensive in the first cost than the purchase of inferior grades, it will be found that the repair and maintenance accounts will be much less than in case the cheaper grades are put up, which will not last more than a few months.

(To be continued.)

The Edison Company in Brooklyn.

The Edison Electric Illuminating Company, of Brooklyn, sent last week a notice to users of electric lights which states:

"The Edison Electric Illuminating Company, of Brooklyn, by its contract with the Edison Electric Light Company, has the exclusive right to sell incandescent lamps in the city of Brooklyn. The Edison patents on the incandescent lamps have been sustained by the United States Court of Appeals in this circuit, and all persons using or selling incandescent lamps in this city, not purchased of us, are infringers of said patents and of the exclusive rights of the Edison Electric Illuminating Company, of Brooklyn."

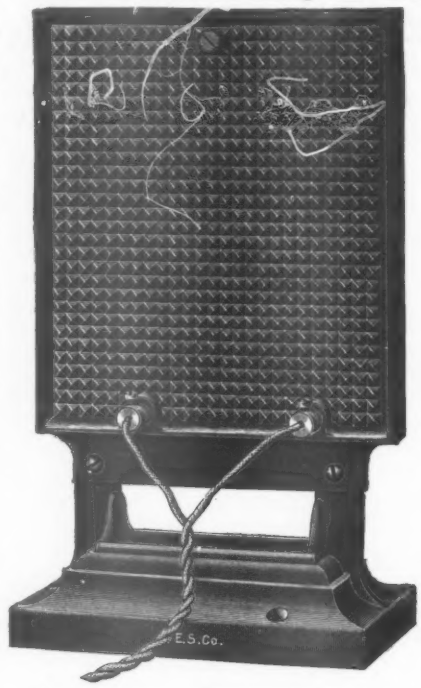


FIG. 6.—ELECTRIC ATMOSPHERIC HEATER.

At the present time the Edison Company furnishes about 5,000 lights in the eastern district. The power station at Gwinnett street and Marcy avenue has a capacity of 125,000 lights, and the underground system will be extended so as to utilize the full capacity of the station.

FIG. 5.—ELECTRIC HEATING.—HOUSE AND OFFICE RADIATOR.

A List and Some Pictures of Pencils.

We have just received a very handsomely covered catalogue of the lead pencils manufactured by the Joseph Dixon Crucible Company. This catalogue, which is intended only for limited distribution, will be gladly sent to all dealers in stationery, and to any who do not possess a full supply of "Dixon's American Graphites," a strictly American product.

For Heating and Eating.

The Carpenter Electric Heating Manufacturing Company, of St. Paul, Minn., have opened an office in this city at No. 126 Liberty street, Mr. F. S. Blackall in charge.

Among the many utensils to which their porcelain imbedded German silver heating coils have been applied may be mentioned: Sad irons, glue pots, soldering irons, broilers, tea and coffee boilers, atmospheric and car heaters, annealing ovens and embossing plates.

The apparatus manufactured by this company is made in neat style, and, where necessary, the articles are heavily nickel-plated.

The simplicity of their working parts makes it practically impossible for them to be destroyed by ordinary usage, and the non-conducting material, asbestos paper, which surrounds the enclosed coils, enables them to be placed anywhere without heating, to any great extent, surrounding objects. For the coils, ordinary German silver No 14 B. W. G. is used.

In the directions accompanying each utensil several cautions regarding their use are advised. The utensils should never be immersed in water. For cleaning, wet rags or brushes should be used. Switches must be used in place of sockets, and all the apparatus manufactured by the company is intended for circuits of 50 and 110 volts. About an average of 7 amperes are required for the different utensils. Several illustrations appear on this and the preceding page showing the apparatus of the company.

It is to be hoped that the general introduction of electric heating apparatus is merely a matter of time, and that it will be in the near future, after the price of the apparatus, etc., will have become more popular, that we shall see this special application of electricity stand in the front ranks of electrical progress.

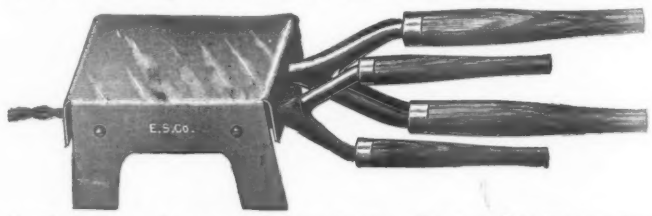


FIG. 7.—ELECTRICITY ACCOMMODATES THE LADIES.—VIEW OF HEATER FOR CURLING IRONS.—NO MORE ALCOHOL LAMPS TO SET FIRE TO HOTELS.

An International Telephone Company.

The Harrison International Telephone Company has been incorporated in Illinois, with headquarters at Chicago. The capital stock is the snug little sum of $80,000,000, and the directors are men of means and influence, widely known throughout the West. Among them are named Hon. Geo. R. Peck, general solicitor of the Atchison, Topeka & Santa Fe R. R., a former director in the Missouri & Kansas Telephone Company, a licensee of the Bell; Hon. R. C. Kerens, a wealthy St. Louis member of the National Republican Committee; Major Wm. Warner, of Kansas City, Mo., ex-Congressman and ex-Commander G. A. R.; Howard M. Holden, a wealthy citizen of Kansas City, and Dr. E. M. Harrison, of Fort Smith, Ark., the inventor of the telephone system to be exploited.

The REVIEW is not acquainted with the inventive doctor, nor with his invention, but does know the other gentlemen named, and a more capable quartette of individuals, financially and intellectually, would be difficult to find in any Western corporation. Their presence in this company gives it an enviable strength and influence, and would indicate that there is to be some lively opposition to the Bell Company and its licensees.

The dispatch from Chicago containing the above information also states:

The company proposes to construct a circuit connecting New York, Boston, Buffalo, Cleveland, Detroit, Chicago, St. Louis, Louisville, Cincinnati, Pittsburgh, Philadelphia, Washington, Baltimore, and thence back to New York. The Harrison patent will be used. The object of the company is to furnish cheaper telephone service.

The circuit will cost $10,000,000. The company will use automatic switchboards and do away with the telephone girl. The company will also have a new system of telegraphy by which messages are written out and an exact *fac simile* is transmitted to the receiver.

Improved Arc Lamps.

DESCRIPTION OF THE GENERAL INCANDESCENT ARC LIGHT COMPANY'S NEW LAMPS.

A large increase in candle-power which may be obtained for a certain expenditure of energy in the new arc lamp when compared with the incandescent lamp, makes it appear rather singular that the introduction of arc lamps on incandescent circuits has not been more general. It is now evident that this method is rapidly becoming more popular, and arc lamps on a constant potential circuit will occupy a position almost on a par with that of the incandescent lamp.

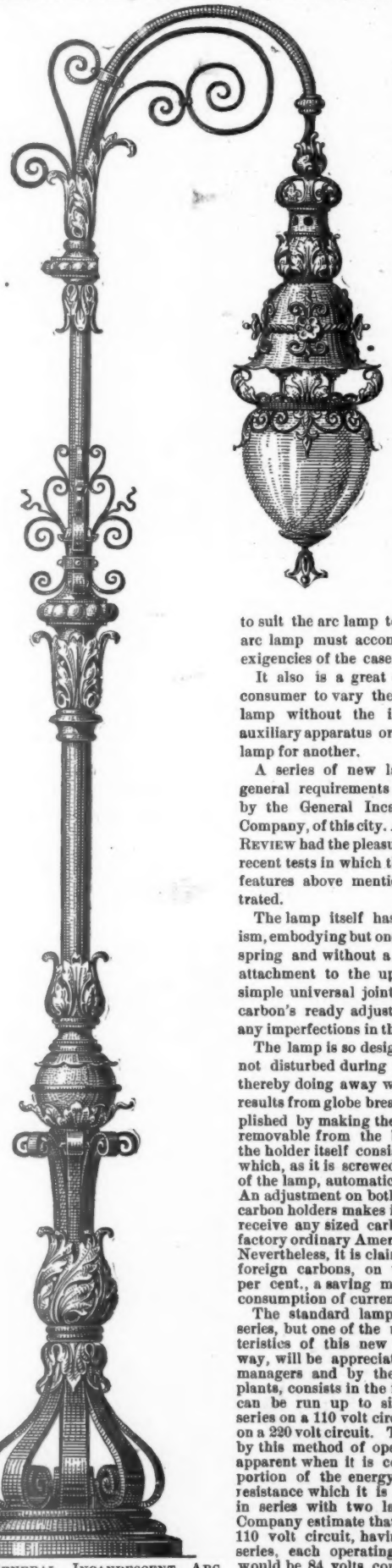


FIG. 1.—GENERAL INCANDESCENT ARC LIGHT COMPANY'S ORNAMENTAL STANDARD AND LAMP.

The great intensity of the arc has largely precluded the possibility of its general introduction for interior illumination. It is evident, therefore, that a suitable decrease in the intensity and a corresponding subdivision of the lamps themselves would make their application to such illumination a practical possibility. To obtain this end the arc lamp must be of such a character that it will equal the incandescent lamp in steadiness of illumination, and also its range of illuminating power must be variable to suit the needs of each individual customer. To obtain perfect steadiness, an arc lamp on a constant circuit must be able to provide for all variations in the voltage of the circuit upon which it is operated.

No circuit is absolutely constant in voltage and it follows, if it is desired to suit the arc lamp to the circuit, that the arc lamp must accommodate itself to the exigencies of the case.

It also is a great convenience for the consumer to vary the candle-power of his lamp without the introduction of any auxiliary apparatus or without changing his lamp for another.

A series of new lamps to fulfill these general requirements has been brought out by the General Incandescent Arc Light Company, of this city. A representative of the REVIEW had the pleasure of witnessing some recent tests in which these most interesting features above mentioned were fully illustrated.

The lamp itself has very simple mechanism, embodying but one magnet with a single spring and without a dash-pot. A unique attachment to the upper carbon rod is a simple universal joint which allows of the carbon's ready adjustment independent of any imperfections in the shape of the carbon.

The lamp is so designed that the globe is not disturbed during the act of trimming, thereby doing away with an expense which results from globe breakage. This is accomplished by making the lower carbon holder removable from the bottom of the lamp; the holder itself consists of a slotted screw which, as it is screwed home in the bottom of the lamp, automatically grips the carbon. An adjustment on both the upper and lower carbon holders makes it possible for them to receive any sized carbon. For tests in the factory ordinary American carbons are used. Nevertheless, it is claimed that by the use of foreign carbons, on which the duty is 50 per cent., a saving may be obtained in the consumption of current.

The standard lamps are run two in a series, but one of the most marked characteristics of this new lamp, which, by the way, will be appreciated by central station managers and by the owners of isolated plants, consists in the fact that these lamps can be run up to six amperes, three in a series on a 110 volt circuit, or six in a series on a 220 volt circuit. The great gain effected by this method of operation will be readily apparent when it is considered that a large portion of the energy is consumed in the resistance which it is necessary to include in series with two lamps. The General Company estimate that, taking the ordinary 110 volt circuit, having two arc lamps in series, each operating at 42 volts, there would be 84 volts consumed in the lamps proper and 26 volts would be consumed in overcoming the resistance, thus involving a loss of about 25 per cent. in current energy. With the General Company's lamps, operated three in series, each lamp takes 35 volts, which makes a total of 105 volts consumed in the three lamps, and the remainder, only five volts, is consumed in overcoming the resistance in series. There is involved a loss of only five per cent., that is to say, one-fifth of the amount lost where two lamps are used. Owing to the distribution thus obtained by the division of the total illuminating power into three parts, it is obvious that the gain in applied illumination is considerable.

Some experiments have been made in reference to the use of arc lamps on incandescent circuits being able to operate at varying voltages without adjustment, and they have given remarkable proof of the excellent design of the company's new lamps. Thus, three lamps in series, while operating at a normal potential of 110 volts, had their potential increased until it reached 120 volts. Not the slightest flicker or tremor in the arc could be noted, and the expected result, *i. e.*, the increase of the illuminating power of the lamp, was immediately apparent. The potential was then decreased gradually from 120 to 100 volts, *i. e.*, 10 volts below the normal. As was again expected, a natural decrease in candle power occurred, but without any other effect on the arc. Taking into consideration the frequent variations of the voltage on constant potential circuits, this quality of the lamp will be thoroughly appreciated by all users.

Simply by increasing the current in the lamp the candle-power may be correspondingly increased. This fact naturally recommends it to central station managers and owners of isolated plants. The experiment demonstrating the fact that the lamp may be run with a current of from three to 20 amperes without any adjustment of the mechanism proper, other than the shifting of the contact of an external resistance connected in series with the lamp, was witnessed by a REVIEWITE. On the standard rack rod lamp the required resistance is attached to the lamp itself and is thoroughly insulated from the body of the lamp by solid porcelain insulators. Experience has shown that these insulators afford a much better security from moisture and constant leakage, which occurs when any substance is employed which is liable to absorb moisture.

FIG. 2.—ANOTHER FORM OF LAMP.

A very ingenious and well constructed external resistance coil has been designed by this company, which may be placed in any convenient part of the circuit, and which is accessible without disturbing the lamp. This resistance coil is in the shape of a triangular prism, on the vertical edges of which are placed porcelain saddles having the German silver wire wound around them. A flexible insulated wire with a suitable clamp affords an easy means of changing the resistance. There being no combustible materials used in its construction, it follows that this rheostat is perfectly fireproof.

In the accompanying engravings are illustrated a few of the many styles of lamps which are designed by this company, from the ordinary plain type to the most ornate. The lamp designed to burn 12 hours, operating three in a series, at 6 amperes, and giving between 700 and 800 candle-power, weighs but 18 pounds, and is 42 inches long. Recent tests give, respectively, 1,000 and 1,300 candle-power to the 8 and 10 ampere lamps operating two in series.

FIG. 3.—ANOTHER VERY POPULAR DESIGN.

One of the most ingenious lamps shown in their rooms, and which is adapted for low ceilings, has been called the Bijou lamp. This lamp is not supplied with a rack movement, but a ribbon controls the motion of the sliding carbon rod. It is very evident that there is a great field open for this lamp, as it is small, compact, ornamental and admirably adapted for interior illumination. This lamp when operated three in series will give an aggregate illumination of 1,600 candle-power, and will require six amperes when run on the usual circuit. It is very evident that this will be equal in point of illumination to the light given by 100 incandescent lamps, but in point of economy the cost will be equal to that of 1216-candle-power incandescent lamps. The small size and artistic appearance of the lamp are not its least recommendations. Its steadiness is equal to that of the incandescent lamp, and the objections raised on this head against the unsteadiness of the arc lamp, and its consequent inappropriateness for interior illumination, are now completely overcome. The time is not far distant when this smallest arc lamp will be seen in the *salon* as well as in the public hall.

The General Incandescent Arc Light Company, of which Mr. Sigmund Bergmann, the widely known electrical manufacturer and inventor, is president, and Mr. P. H. Klein, his efficient co-worker for many years, is secretary, has its general office at the corner of Duane and Elm streets, New York city, with its show rooms at 275 Fifth avenue. The works of the company, in which the above experiments were tried, occupy a large building, which it owns, at the corner of Thirty-third street and First avenue, where the smallest details of the lamp are manufactured, the equipment of the factory being complete and convenient in every respect.

The Canadian Electrical Association.

The second meeting of the association took place here on Wednesday and Thursday of last week. The attendance was large, considering the season, and very enthusiastic. The first day's meeting opened with an address by the president, Mr. J. J. Wright, as follows:

Since last I addressed you several changes of importance have taken place in its aspect, and new departures have been made that will have considerable influence on the future of the electrical business in Canada. The adoption of electricity as a motive power on suburban railroads, and the conversion of horse tramways, have developed in a manner that for rapidity is without a parallel in the history of modern civilization. While a year or two ago it was thought that the limit of production had about been reached, and the demand for electrical apparatus filled by the occupation of the field of arc and incandescent lighting, it is a fact that to-day our workshops are as far behind in keeping the market supplied as at any time in the history of the business. This, occurring as it does during a period of general depression, must be looked upon as eminently satisfactory and as affording a guarantee of much greater expansion in the future. I have to congratulate the members of this association that their field of usefulness is becoming wider, and that the outlook ahead is so bright and full of promise. While this is the case, and it is undoubtedly a fact that solid and substantial progress has been made by conservative management of electrical enterprise, a word of caution may not be out of place to investors on securities based upon electrical speculation. There is a danger that the fact of this solid progress may be made the means of ultimate injury to the concerns identified with it. It has caused a growth of schemes, having electricity as a basis, to spring up as thick and fast as mushrooms. The inevitable failure of many of these will discredit, to a certain extent, legitimate enterprise and profitable business. The many schemes for the long distance transmission of power, though scarcely to be classed with what may be termed the electric fake, are still somewhat far removed from the line of commercial success.

Experimentally, much has been accomplished in this direction, though the complicated nature of the apparatus and its cost for operation and repairs make financial success rather more than problematical. At the last convention of this association I took occasion, in opposition to views then set forth, to mildly satirize the hundred miles an hour enterprise that was to carry the denizens from the wilds of Missouri to the World's fair at Chicago. Where is that enterprise to-day? Several miles of road are constructed—all but the track—in a straight line, too, I believe, as considered necessary by the projectors, but no plans are forthcoming, and we do not see the name of any engineer of standing connected with the scheme. The sole energy of the promoters appears to be expended in the production of a very rosy-colored prospectus showing impossible profits and an elaborate engraving of the happy farmer sawing wood and pumping water by electric light and power for a couple of miles on either side the right of way. To come nearer home. Good hard dollars have been extracted from the pockets of liege subjects of the Queen in the name of electricity, as the magic wand was waved even under the nose of Brock's effigy on Queenston Heights. Where is that scheme now? The Utopian dreams of a railroad on every farm that is being promulgated now will not materialize in our generation, except as a sink hole for the funds of the unwary. A word of warning is needed now, and as president of this association I give it. It is open to you to dissent from this position, to criticise it if you see fit, and to prove it needless if you can. The safety of legitimate electric enterprise is endangered by this trading upon the credulity of the people. Nevertheless, genuine electric business has made solid progress, its area is gradually widening and a natural and healthy growth will find increasing occupation for its earnest workers and afford a fair and reliable return to present investors.

During the half year just passed there does not appear to have been many new developments in the scientific application of electricity. Effort appears to have been expended in perfecting already known appliances and inventions. Much progress has been made in this field. The best efforts of electricians and mechanics have been devoted to street railway appliances, and, while much yet remains to be done, a distinct advance has been made in the perfection and durability of railroad plant. Some new departures have been made in the engineering branch. At our last convention I described what I considered to be the ideal engine for electric light work. That engine has been constructed, and I shall presently have pleasure in asking you to examine its operation. It has more than justified the anticipation of its designer, and has proved a remarkable success. The vertical type of large engine has entered the field of electric work, and is there to stay. Electric generators, taken as units, are gradually growing larger; 250 horse-power is not an uncommon size, and the largest yet designed and constructed on this side of the Atlantic has attained to the extraordinary capacity of 2,000 horse-power.

I would like to foreshadow action by this association such as would unite in a closer bond the members whose interests are to a considerable extent identical. It will become an important matter for us to decide, if it is seen fit, either at this convention or at the annual meeting in September next, whether it would not be advisable to organize subsections of the association to more successfully grasp and deal with details that would be somewhat beyond the scope of the association in its entirety. Such, for instance, as the question of fuel supply. In the province of Ontario alone, where all our coal has to be imported from outside sources, the amount consumed for the purpose of generating electricity must reach a considerable sum in the aggregate. United action on the part of owners and operators of central stations, which would establish direct communication with the miners of coal, might result in considerable advantage in the matter of its ultimate cost. A sub-section of the association, comprising central station owners and operators, could handle a question of this kind, while, on the other hand, it would not be of great interest to a large contingent of members interested in other branches of electrical science. Electrical men generally, who are all more or less consumers of electrical supplies, are interested in the question of railroad freight and charges.

FIG. 1.—THE ELECTRIC GAS LIGHTING COMPANY, BOSTON.—VIEW OF PART OF THE STOREROOM.

THE PROCEEDINGS.

A number of papers were presented, notably Mr. Block's paper on measurements, one on underground construction, particularly in reference to telephone work in Toronto, by Mr. Tower, and one on explanation of the application of the motor dynamo to telegraph purposes, by Mr. Wright.

The papers were suitably and fully discussed, when the convention adjourned to meet at McConkey's, when the annual dinner was enjoyed by the members amid toasts to the Queen and general good fellowship.

The second day's proceedings were marked by the presentation of several good papers, among them Mr. Campbell's paper on "Free Wiring," on which opinions differed very much. Mr. Roseburgh, of the School of Science, presented an interesting paper on the methods for speed control applied to dynamos and power to prevent fluctuations in the current pressure. Mr. Breithaupt presented a paper interesting all on the probabilities of long distance distribution at high pressures. This paper is particularly interesting owing to the general interest taken in all schemes in connection with Niagara's power, of which there have been so many proposed of late. The meeting was brought to a close after the discussions were ended, subject to the call of the secretary, to meet again in Toronto.

The meeting was pronounced a most successful one, and augers well the future prosperity of the association. The attendance was as follows: Vice-President John Carroll, Eugene Phillips Electrical Works, Montreal; Secretary-Treasurer C. H. Mortimer, publisher *Electrical News*, Toronto; D. A. Starr, Royal Electric Light Co., Montreal; H. O. Fisk, Electric Light Co., Peterboro; A. B. Smith, Canadian Board Fire Underwriters, Toronto; D. Thomson, general manager Hamilton Electric Light & Power Co.; John Yule, manager Guelph Gas & Electric Light Co., Guelph; Thomas H. Wadland, Bell Telephone Co., Hamilton; L. B. McFarland, Bell Telephone Co., Montreal; A. M. Wickens, Toronto; Geo. Black, G. N. W. Telegraph Co.; J. A. Baylis and W. A. Tower, Bell Telephone Co., Toronto; R. G. Black, Hamilton; A. T. Smith, Bell Telephone Co., Kingston; B. J. Throop, Bell Telephone Co., Brantford; George M. Wright, Montreal; J. H. Greer, Peterboro; H. Beaumont, Kay Electric Works, Toronto; J. W. Taylor, Peterboro; J. A. Kammerer, Royal Electric Co., Montreal; Geo. W. Sadler, Robin & Sadler, Leather Belting Co., Montreal; O. C. Armstrong, Brooks Manufacturing Co., Toronto; W. Bourne, Toronto Electric Light Co.; H. S. Thornbury, Toronto Electrical Works; W. J. Jones, Hugh Neilson and W. B. Evans, Bell Telephone Co., Toronto; W. J. Clarke, Bell Telephone Co., Toronto; R. F. Carter, Niagara Falls, Ont.; Chas. B. Hunt, Electric Light Co., London; Alex. Stark, Bell Telephone Co., Toronto; John Langton, Peterboro; E. C. Breithaupt, Berlin; James P. McQuaide, National Conduit Co., New York; A. C. McCallum, Peterboro, and others.

CANADIAN.

Toronto, Ont., January, 1893.

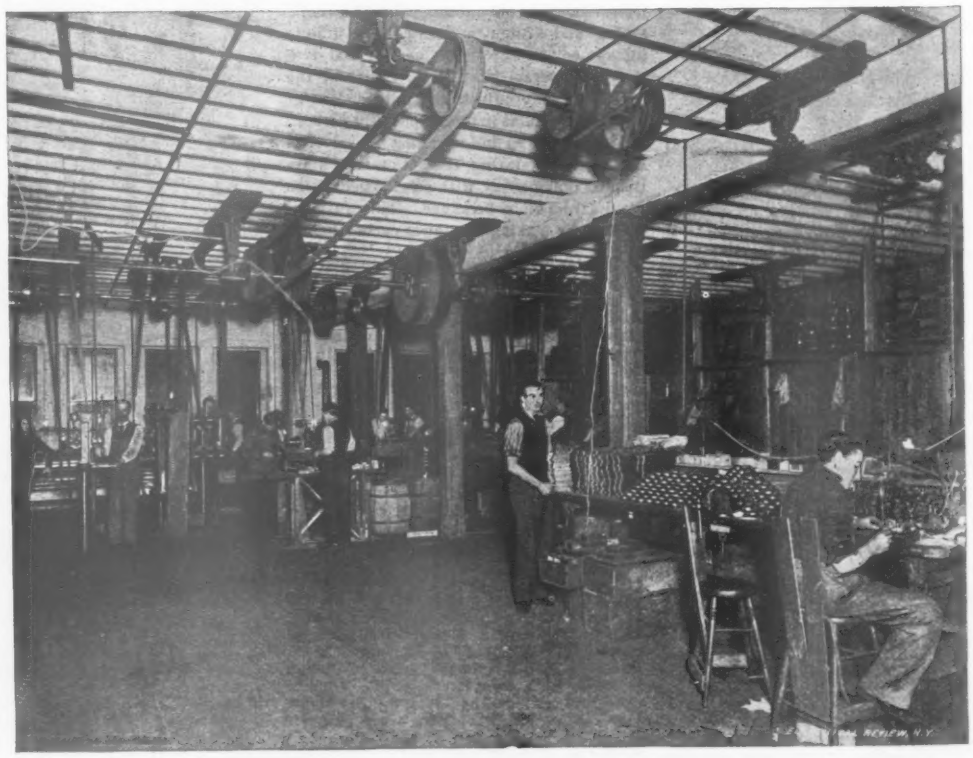


FIG. 2.—VIEW OF A CORNER OF THE WORKSHOP.

Mayor Gilroy last week presided for the first time over the Board of Electrical Control. The mayor declared that he wanted it understood that no streets would be torn up to accommodate companies that did not apply in time, and that no other applications would be considered.

Electric Gas Lighting Company's Plant.

The Electric Gas Lighting Company, of Boston, Mass., which is probably one of the best known concerns in the country, and certainly the pioneer house in their branch of the electrical trade, have marked an epoch in their history with the opening of the new year by moving their manufacturing plant into new quarters, and more than doubling their facilities.

The works are located on the second floor of the seven-story brick building on Dover street, known as the Beebe estate, and occupy some 6,000 square feet of space.

After passing through the superintendent's office, your correspondent found himself at the foreman's desk, from which a view of the entire shop can be had, and every one of the 40 odd men employed is constantly under the eye of that official.

The front of the shop is well lighted by 10 large windows, and immediately in front of these and extending the entire width of the establishment is the bench at which the fine finishing work of the various specialties is handled. Running back from this is a 40 foot double bench, one side of which is devoted to finishing switches of all kinds, automatic keys and Tyrolean bells, and the other to sectional gas lighting, cut-outs, annunciator work, and painting of same.

Beyond this and extending some distance down the further side of the room is the assembling department for burners. A force of a dozen men is kept constantly employed at this branch of the work alone. Overhead is a suspended shelf, five feet wide and over a hundred feet long, devoted to the storage of finished woodwork. This consists of hundreds of annunciator and cut-out cases in every variety of wood, ready to receive the mechanism. A similar shelf on the opposite side of the shop contains the finished work in stock and ready for shipment.

Next in order on this side comes the stock room, and here are piled from floor to ceiling thousands of dollars worth of the many finished parts ready for assembling, as well as immense quantities of bells, burners, screws, brass and copper plates, brass, copper and German silver wire, magnet wire and supplies of all kinds.

In the center of the floor space is the assembling department for bells, and in the rear of this is located the machine shop. Over thirty different machines are in use here, including upright and horizontal drills, engine and speed lathes, punches, screw machines and milling machines. Power is supplied from a main shaft 52 feet long, running through the center of the shop, having a 36 inch driving pulley for the heavy work, and a 24 inch pulley for the lighter machines. The company do their own forging, all their tools, dies and punches being made and repaired on the premises, and also have considerable wood working machinery for finishing bell boxes, bases and other work.

In the rear of the shop are the lockers containing all the special tools, dies, etc., used in the various branches of the work, some of which represent several hundred dollars in value. Two very important departments are the buffing and plating rooms, which connect and have been specially fitted up for this class of work. The buffing room is 15 x 15 feet, and the plating room is about twice as large. Here every description of oxidizing, plating and coloring is handled, besides a special department for the manufacture of zincs for Samson batteries.

A large freight elevator is conveniently at hand, and the shipping facilities are first class. Taken altogether, the plant is an excellent one, no money having being spared in its equipment, and very good judgment being displayed in the way it is arranged.

In the early days of electrical progress, as far back as 1880, the company was known as the National Electric Gas Lighting Company, and an ex-mayor of Boston was president.

In 1881 Col. L. W. Burnham was elected to the presidency, and immediately reorganized the company under its present title.

Manufacturing on their own account was not begun until 1885, and was even then carried on under many difficulties, their shop being located in the attic of the New England Electric Company.

Since that time, as business steadily developed under Col. Burnham's management, backed up by an able board of directors, their facilities have been increased and today the company stand at the head and front of the business, with unrivalled facilities for manufacture, and one of the finest salesrooms in the city of Boston.

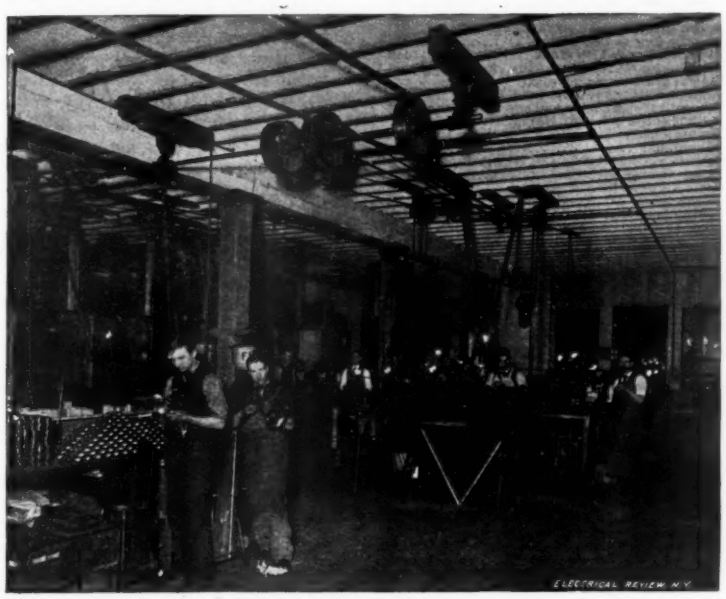


FIG. 3.—THE ELECTRIC GAS LIGHTING COMPANY, BOSTON.—ANOTHER VIEW IN THE WORKSHOP.

Report of the Chicago Edison Company for 1892.

The following report of the Chicago Edison Company for the year 1892 shows clearly what has been done by this company in the Windy City.

Gross earnings, all sources, $872,665; expenses, $551,609; net earnings, $321,056. Brought forward from last year, $244,000; total available for dividends, $565,056. Dividends paid, $90,000; carried forward, $475,056.

The net earnings of the company were, as above, $321,000, which is at the rate of 32 per cent. on the capital with which the company started in the year, and at the rate of 21 per cent. on the present capital. The capital was increased from $1,000,000 to $1,500,000 during the latter part of 1892. The company was organized in 1887 with a capital of $500,000. This was increased in 1890 to $750,000, and again increased in 1891 to $1,000,000, at which point it stood during most of the year 1892.

The company has outstanding bonds to the amount of $130,300.

The number of incandescent lights connected with the system is 99,225. Motors are operated to the amount of 2,044 horsepower. The sum expended during the year on additions to the plant was $385,000. Extensions and enlargements of plant are projected at an expense of $1,180,000. This company will acquire control of the Chicago Arc Light and Power Company, said to be earning $150,000, or eight per cent. on its stock, thus giving it a monopoly in the city.

FIG. 4.—THE ELECTRIC GAS LIGHTING COMPANY, BOSTON.—VIEW OF THE VERY BUSY MACHINE SHOP.

Over Fifty Miles an Hour.

HIGHLY SUCCESSFUL INSTALLATION OF AN ELECTRIC ELEVATED ROAD IN LIVERPOOL.

The following letter from our London correspondent should especially interest the owners of the elevated roads of this city. There is no practical reason why this clean, economical and reliable system of traction should not be adopted in New York. The expense of the change would not be great when the increased revenue is considered. Every one of the new roads that now seem probable should be constructed with a view to the use of electricity. Our correspondent says:

A few days ago a trial train was run over the system of a new overhead electrical railway at the Liverpool docks. The carriages were occupied by the directors, the chief officials and a large number of distinguished guests invited for the occasion, and everything passed off to their entire satisfaction. Accordingly the line will be formally opened for traffic by the Marquis of Salisbury on February 4.

This railway is absolutely unique. Our one London electric railway is underground. In your elevated railways the motive power is steam. Here the railway runs its whole course overhead, and the motive power is electricity. The carriages run without the unsightly and noisy accompaniment of a locomotive; and neither will the atmosphere be charged with smoke from an engine funnel, nor will passengers on the ground below be subjected to showers of sparks or cinders.

The line extends along the whole length of the docks of Liverpool from north to south a distance of six and a-half miles. On the trial trip the journey, though stopping easily and precisely at the various stations, was accomplished in seven and a-half minutes.

The cost, including equipment, was about £85,000 per mile. At the dinner, which was given in the evening, Sir N. B. Foxwood, Chairman of the Overhead Railway Company, estimated that an annual traffic of 1,000,000 persons (which is less than that of the omnibusses now plying there) will yield a dividend of 5 to 6 per cent.

One Advantage of the Telephone.

Many unkind things are said of the telephone, but one of its redeeming features is that you can't lend money through it.—*Philadelphia Record.*

ELECTRICAL REVIEW

Published at 13 Park Row,
P. O. Box 3329. NEW YORK.

EDITOR:
CHARLES W. PRICE.

ASSOCIATE EDITORS:
STEPHEN L. COLES.
ROBERT H. READ.

REGISTERED CABLE ADDRESS:
"ELECTVIEW," NEW YORK.

"1546 CORTLANDT." TELEPHONE CALL.

BOSTON OFFICE:
H. G. TUCKERMAN, Room 29, 620 Atlantic Ave.

WASHINGTON OFFICE:
GEO. C. MAYNARD, 1409 New York Ave.

CHICAGO OFFICE:
MERWIN J. BULKLEY, 435 "The Rookery."

ADVERTISING DEPARTMENT,
H. T. RICHARDS, Manager.

PATENT BUREAU,
ROBT. H. READ, Manager.
Patents procured in United States and all foreign countries. Searches, Investigations and Reports on Validity and Infringement.

ANNOUNCEMENT.

Address all communications and make all money orders and checks payable to order of ELECTRICAL REVIEW, P. O. Box 3329, New York.

No attention will be paid to communications for the REVIEW without the *name and address of the writer.*

SUBSCRIPTION TO THE
ELECTRICAL REVIEW.

One Year, United States and Canada, - $3.00
One Year, Foreign Countries, - - 5.00
Single Copy, - - - - - - - .10

NEW YORK, FEB. 11, 1893.

CONTENTS.

	PAGE.
Views, News and Interviews	293
An Ingenious Electric Signal	293
Non-Magnetizable	293
Light and Power Stations	293
The Edison Company in Brooklyn	294
A List and Some Pictures of Pencils	294
For Heating and Eating	294
An International Telephone Company	294
Improved Arc Lamps	295
The Canadian Electrical Association	296
Electric Gas Lighting Company's Plant	297
Report of the Chicago Edison Company for 1892	297
Over Fifty Miles an Hour	297
One Advantage of the Telephone	297
Boston to Chicago—Short Time Between Talks.	298
Electricity in the Kitchen	298
Correspondence;	
Our Boston Letter	299
Our Chicago Letter	299
A Reply From Mr. Lockwood	299
Announcement to World's Fair Exhibitors	299
Personal	299
Letters From a Laboratory	299
Electric Heating and Electric Metal Working	300
What is Electricity?	301
Electrical Advertising	301
A Handsome Factory	301
The Trolley	301
Journey Jottings	302
The Passing Away of the Electric Club	302
Advance Information	303
Queen's Portable Photometer	303
Kindred Interests	304
A New Electric Light Plant in Logansport, Ind.	304
Electrical Patents	x
Crinoline and Street Cars	x
Electric Light Flashes	x

INDEX OF ADVERTISERS.

COVER PAGES.

	PAGE.
American Electrical Works, insulated wire.	i
Ansonia Brass & Copper Co., wire	xvi
Armington & Sims, engines	xvi
Babcock & Wilcox Co., boilers	xvi
Beacon Vacuum Pump Co., inc. lamps	i
Brush Electric Co., apparatus	xv
Campbell Electrical Supply Co., insulating tape	i
Crocker-Wheeler Motor Co., motors	i
Day's Kerite, insulated wire	i
Dwight Slate Machine Co.	i
Eastern Electric Cable Co., insulated wire	xvi
Eddy Electric Mfg. Co., motors	i
Faraday Carbon Co., carbons	i
Hampson & Co., E. P., engines	xvi
Jewell Belting Co., belts	xvi
Massachusetts Chemical Co., insullac	i
Mather Electrical Co., power generators	i
Moore, Alfred F., wire	xvi
Noye Mfg. Co., John T., engines	xvi
Okonite Co., insulated wire	i & xvi
Otis Bros & Co., elevators	xvi
Paine & Ladd, patent attorneys	i
Riker Electric Motor Co., motors, dynamos.	i
Simplex Electrical Co., insulated wire	i
Waterhouse, Gamble & Co., arc lamps	i
Westinghouse Electric & Mfg. Co., electrical apparatus	xv
Weston Engine Co., engines	i
Wilmot & Hobbs Mfg. Co., bell gongs	xvi

INSIDE PAGES.

Alexander, Barney & Chapin, sal ammoniac	iii
Allis & Co., Edward P., engines	xi
American Bell Telephone Co.	xii
American Engine Co., engines	ix
American Fluoride Co., fluoride	xi
Arbuckle, F. P.	304
Baker & Co., platinum	304
Ball Engine Co., engines	x
Barrett, John A., electrical engineer	x
Berlin Iron Bridge Co., iron roofs and buildings	xiv
Bickford & Francis Belting Co., belts	ix
Bishop Gutta Percha Co., insulated wire	viii
Blaisdell & Co., tools	xi
Boston Gear Works, gears	xiv
Brill Co., J. G., tramway cars	xii
Brown Electric Co., electrical supplies	iii
Buckeye Engine Co., engines	xi
Carpenter Enamel Rheostat Co., rheostats	xiii
Case Engine Co., J. T., engines	viii
Central Electric Co., supplies	iv
Chicago, Milwaukee & St. Paul Railway Co.	304
Church & Sleight, tools and supplies	xiv
Clark Electric Co., arc lighting	xii
Cowles Electric Smelting & Aluminum Co., aluminum	x
Cutter Electrical & Mfg. Co., reflector shade	viii
Cutter, George, electrical supplies	viii
Day's Kerite, wire and cables	viii
Detroit Electrical Works, apparatus	viii
Dewey Electric Heating Co., electric heaters	iv
Dixon Crucible Co., belt dressing	xii
Dunderdale, F. C	xiii
Electric Gas Lighting Co.	vi
Electric Secret Service Co., cut-outs	xiii
Electro-Light Engraving Co., engraving	xiv
Empire China Works, porcelain specialties.	xiii
Falls Rivet & Machine Co., friction clutches.	xi
For Sale	304
Garvin Machine Co., tools	xi
General Electric Co., inc. lamps	v
General Incandescent Arc Light Co., arc lamps	vii
Gleason Manufacturing Co., E. P., electrical appliances	xii
Goodyear Hard Rubber Co., hard rubber	304
Greeley & Co., The E. S., supplies	iv & 304
Harrisburg Foundry & Machine Works, engines	xiv
Hart & Hegeman Mfg. Co., switches	x
Holman Electrical Co., F., reflector shades.	iii
Holmes, Booth & Haydens, insulated wire	xii
Johns Mfg. Co., H. W., vulcabeston	vi
Lake Co., J. H. & D., pulleys	xiii
Leclanche Battery Co., batteries	ix
Lehigh Valley Creosoting Co., creosoted lumber	ix
Leffel & Co., James, water wheels	iv
Marshall, Wm., condensers	xiv
Morrison, Geo. H., indicators	xi
National Electric Mfg. Co., dynamo electric machinery	iv
New England Butt Co., braiding machinery.	xiii
Newton Rubber Co., hard rubber	viii
New Jersey Lamp & Bronze Works, electric and gas fixtures	ix
New York Belting and Packing Co., rubber belts	xii
New York Insulated Wire Co., wires and cables	xiii
Onondaga Dynamo Co., electrical apparatus	xiv
Oppenheimer, M. L.	304
Ostrander & Co., W. R., supplies	xiii
Palmer Bros., engine castings	304
Partrick & Carter Co., electrical supplies	x
Penn Life Co., insurance	304
Phœnix Glass Co., glass globes	xiv
Phosphor Bronze Smelting Co., castings	iv
Prentiss Tool & Supply Co., machinery	304
Queen & Co., electrical instruments	304
Railway Equipment Co., elec. r'y supplies	iii
Reed & Co., F. E., lathes	xiv
Rhode Island Tool Co., tools	iii
Ridlon & Co., Frank, general machinery	xiv
Ries Electric Specialty Co., regulating socket	xiii
Robinson & Orr, steel rails	304
Rosenbaum, Wm A., patent attorney	x
Royce & Marean, electrical supplies	xiv
Russell & Co., steam engines	xi
Samson Cordage Works, braided cord	viii
Schuyler Electric Co., arc lighting	xii
Shawmut Fuse Wire Co., fuse wire	xi
Shoemaker, Homer, attorney and counselor-at-law	304
Stanley Electric Mfg. Co., transformers	ix
Standard Paint Co., insulating compounds.	xi
Stevens & Morris, engravers	iv
Stocking, E. B., patent attorney	x
Swan & Lane, contractors	304
Tregoning, John, books	304
Tyndall, Wm. D., attorney	x
Walworth Mfg. Co., trolley poles	iii
Wanted	304
Washburn & Moen Mfg. Co., wire	x
Western Electric Co., supplies	iv
Willson, H. B., patent attorney	x
Wilson, Fremont, electrician	304

To be in style, start a telephone company.

The primary battery for light and power is now attracting the gullible ones in Boston.

Now we shall see what this week will bring forth, whether from out of the mountain shall come forth a mouse or an elephant?

It seems Edison has resolved to show his kinetograph at the World's Fair. There will probably be some who will say that the machine is a toy. Let them beware; a certain person once said that the telephone was a toy, and see what an ignominious end has been his.

Prof. George Forbes, of London, writes that he will, in all probability, attend the St. Louis meeting of the National Electric Light Association, and, if he can find time to do so, will prepare and read a paper there. In addition to the lecture by Mr. Tesla, in which he will give practical demonstrations of high frequency currents, there will be papers by Mr. Sterling on "Some Experiences with the Alternating System"; Mr. Bradley on "Long Distance Transmission of Power"; Mr. Stillwell on "Under What Conditions is the Use of Water-Power Economical?" Mr. Myers, "Preservation of Poles and Cross Arms"; Mr. Townley, "The Incandescent Lamp;" Messrs. Stanley, Brophy, Bell, Armstrong, Browne and Adams, subjects to be announced.

The sensible and timely remarks of President J. J. Wright, of the Canadian Electrical Association, delivered at the recent meeting, will be read with interest. President Wright's criticism of the base uses to which the name of electricity is often applied sounds a timely note of warning.

And now dentists are urging the employment of electricity for the production of local anæsthesia. An authority on the subject states "that if the positive and negative poles (he does not mention the kind of current, the quantity nor intensity) are brought into firm contact on the gum at both sides of the root or tooth to be extracted, the ends of these electrodes being of cup or saucer-like form, within which is placed sponge or cotton saturated with a four or six per cent. solution of cocaine, absolute alcohol, or mixed ether and chloroform, and then if the current be gradually turned on to the required strength, this preparation is made to permeate the tissue sufficiently to cause local anæsthesia, and the subsequent extraction of the tooth is consequently painless.

In the REVIEW last week appeared the Report of the Sub-Committee on Provisional Programme for the International Electrical Congress of 1893. The value of having absolute and universal standards cannot be over-estimated. The late Baron de Rothschild had this maxim printed, among many others, and hung up over the desk of every clerk in his employ: "Take time to consider, and then decide quickly." As one of the maxims of a successful man, it should be followed by all sensible individuals. So it is in the case of selecting standard units and giving each its most appropriate designation. Let all discussion be before any report is presented. The plan as laid out by the committee is the result of careful deliberation, and all electrical journals and others concerned should do all in their power to aid them. Then, once the decisions are made by the able and competent committee, we should have appropriately named standards which should be comprehensive, clear and, in short, satisfactory.

Our quick-sighted and able daily contemporary, the *Sun*, notes the passing away of the ancient Fire King, and the entrance on his heretofore undisputed domain of the young conqueror, Electricity, in words of welcome and rejoicefulness as follows:

"The use of electricity in the kitchen for cooking purposes will be a godsend to housekeepers and their help if the electric fluid can really be made to render as good and sure service there as is rendered by coal, wood or gas. It is already used successfully and satisfactorily in some establishments.

"The use of electricity in the kitchen may be disadvantageous to the coal-cart drivers, the coal miners, coal dealers, coal trusts, coal lords, and gas companies; but we can't help that. These people must be willing to suffer their share of the disadvantages of progress, invention, science. The electricians are bound to prosper. We cannot surely run short of electricity."

BOSTON TO CHICAGO—SHORT TIME BETWEEN TALKS.

The ceremonies devoted to proper recognition of the official opening of the electric line connecting Boston and Chicago conversationally are occurring in the cities named as we go to press—4 to 7 o'clock Tuesday afternoon. This lengthens the line from Chicago to New York some 300 miles, and mingles the cultured accent of the Athens of America with the brusque vernacular of the hustling, get-there city on the shores of our inland sea. The telephone equalizes and cements the various elements of our United States in a way peculiarly its own, and the remarks that the Governor of Massachusetts at Boston may make to the Governor of Illinois at Chicago on this occasion should become as historical (not because of verisimilitude, perish the thought!) as the suggestion that passed from the Governor of North Carolina to his brother of South Carolina. The telephone is great. We think it is the peer of any invention known to man, if not out-classing all.

ELECTRICITY IN THE KITCHEN.

Electric cooking is now coming into a commercial stage. A fully illustrated article in this issue of the ELECTRICAL REVIEW describes utensils now on sale in the market. It has been the fashion for electricians to bridle with a conscious air of knowing it all when the subject of electric heating is raised, and confidently tell us what a great number of horse-power we must use in domestic operations with electric heaters. In one sense they are right, but in another they are wrong.

We must, of course, in electric heating, allow for all the waste in converting the coal at the central station into heat and the heat into steam and the steam into current, and the incidental heat losses of line transmission. But let us suppose we are waiting for a simple breakfast, and score down the items rolled up on our accounts current by Chloe, in the kitchen, while she is converting the raw material of the butcher and grocer into a manufactured product that will meet the approbation of our palates.

First let us suppose she is operating the coal range. Item: One bundle of kindling to start her fire, two cents; item: one-half of daily coal outgo (one ton per month), ten cents; total, 12 cents. Let us thrust out of view for the present why she uses so much coal, remembering only the cardinal and imperious fact that she gets away with one ton of coal in one month to operate her range, for which our good cash falls with a cold, dull plunk into the pockets of the coal barons. Now let us use electric utensils for the same work. We are having chops, soft boiled eggs, griddle cakes, and coffee—a simple, wholesome and frugal diet if Chloe can cut down the heat tariff. We will first heat two quarts of water which will fix matters for the coffee and the eggs. Item: 4 amperes at 110 volts, 10 minutes, 1¼ cents. Item: chops, 7 amperes at 110 volts for 10 minutes, 2 cents. Item: 15 griddle cakes, 5 amperes at 110 volts for 10 minutes, 1¼ cents; making the aggregate cost for heat 4¾ cents, at the end of which time off goes the current and the expense stops.

The figures here used are based on the use of the coffee pot, broiler and griddle, electric utensils, and are substantially correct. Their import is simply this, that there are two sides which must be considered in the matter of electric heating.

There are wastes, of course—and where in human experience are there not?—but they are offset by corresponding wastes under any other system of heating. Our kitchen range sends much of its heat up the chimney; that is a necessary waste for which Chloe is not to blame. But the range fire takes time to get under way; it requires kindling or something which is tantamount in outlay thereto; it must be maintained practically all day (and sometimes all night), and then Chloe drops in with her personal equation as uncontrollable as characteristic, and for easy management keeps a roaring fire all day and keeps the janitor busy at the coal bin. So that we must look at the matter as a question of all day or all week efficiency, or rather inefficiency, and here is where electric heating gets in its fine work. It does its work quickly and well; the key is turned, when, presto! things begin to sizzle, so that its wastes are active only while the cooking operations are in full blast.

It is common for some people to cry down gas as an expensive fuel; for some purposes it is, but with Chloe at the throttle it can discount coal by a liberal margin, and electricity can follow as a close second, while in the matter of convenience the latter stands head and shoulders above all other methods. Other incidental offsets might be noted, such as the centralization of the heat at the exact spot where it is wanted; no wastes in heating up a brobdignagian outfit, such as a range, where a small one will do as well. The oven described will furnish for nine cents the heat necessary to send to the table a five pound roast of beef in 35 minutes, or a 12 pound turkey in 45 minutes; that is to say, the current is flowing for those periods; the actual baking or roasting goes on longer, because, after the oven is heated to 300 degrees or more, as required, current may be cut off, and the process of cooking will continue until the roast is "done."

It is not safe to turn electric heating down. Give it a chance, by all means, and, in spite of the numerous losses with which it is charged it may after all prove a good domestic handmaiden.

CORRESPONDENCE.

OUR BOSTON LETTER.

The General Electric Company are now building at Lynn, Mass., an electric mail car for the Rockland and Canadian Electric Railway Company, which will be used for the collection and distribution of mail matter along their route.

The Town of Beverly, Mass., has granted permission by an overwhelming vote for the extension of the Lynn and Boston Railway Company's tracks through their property, and the right to use the trolley system. The vote was polled amidst great enthusiasm.

The Case of the Electric Gas Lighting Company, of Boston, against Fuller, Holtzer & Company, for infringement of their patent on electric gas lighting apparatus, came up for hearing before Judge Carpenter in the United States Court of Equity on Wednesday, February 1. The plaintiffs were represented by E. P. Pason, of Boston, and E. H. Brown, of New York, and the defendants by Mr. Richardson, of the firm of Fish, Richardson & Storrow. Decision was reserved.

The Matter of a Municipal Electric Lighting Plant for Boston is being discussed at some length by Mayor Mathews and other officials, and statistics are being gathered from other cities for a comparison of prices. Figures and detailed estimates have also been submitted on the cost of constructing and operating a plant of the requisite capacity by competent engineers, and a general stir up is on foot. It is needless to say that the companies who are now furnishing the lights have not lost much sleep as yet.

The Campbell Electrical Supply Company, of this city, report a wonderful increase of business on their "Century" insulating tape, and are working day and night to keep up with orders. Trade is coming from all parts of the country, particularly from the South, where it is a great favorite. Their wire trade is also good, and they will be in the market shortly with something new in this line. Their "Double Crown" telephone system is in general use by the police department of this city, and is giving wonderful satisfaction.

An **Addition** has been made to the *personnel* of the Sawtell Company by the admission to the firm of C. E. Davis, a young electrical engineer of this city. Mr. A. H. Sawtell, for some years well known in electrical circles, remains at the head of the concern, and they have recently moved into new quarters at No. 146 Franklin street. The change was necessary, from the fact that they are extending their business into new fields, and will in future handle a full line of electrical supplies, besides doing all kinds of light construction work. They control the New England agency for the Springfield Motor and Switch Company, and will continue the business of renewals of burned out incandescent lamps as heretofore.

The **Incandescent Lamp Case.**—After an adjournment of one week, the case of the General Electric Company against the Beacon Vacuum Pump and Electric Company came up before Judge Colt in the the United States Circuit Court at noon, Wednesday, February 1. The defendants had a mass of printed affidavits and the briefs which had been prepared since the last sitting, and both sides were primed for a lengthy argument for and against their admission as evidence. The defense opened with a motion to be allowed to file additional affidavits to those already submitted. This brought forth a vigorous protest from Lawyer Fish, leading attorney for the prosecution, but Judge Colt cut short the argument by deciding in favor of the defendants. This decision did not please Mr. Fish, but he was allowed the balance of the afternoon in which to prepare additional affidavits in rebuttal, and before night had filed 21 of these with the clerk of the court. The evidence of both sides is now in the hands of Judge Colt, and nothing further will be done until his decision is rendered. How soon this will be is a matter of speculation entirely, but both parties are prepared for further action as soon as it is known. If favorable to the General Electric Company, the works of the Beacon Company will be closed up within 24 hours, and the case will then be carried by the latter to the United States Circuit Court of Appeals. If the injunction is refused, the Edison people will carry the case to the higher court, and there it will be tried on its merits. This will prove a matter of some length, and in the meantime the Beacon Company would be free to continue the manufacture of their lamps. This is what they are fighting for, and they confidently expected to win.

The Third Annual Ball of the Massachusetts Electrical Engineers' and Mechanics' Association was held at Odd Fellows' Hall, on Monday evening, January 30, and was an unqualified success, both from a social and financial standpoint. The attendance was quite large. The electrical decorations were the feature of the evening, and undoubtedly the finest ever seen in Boston. Over 15,000 incandescent lights were used in the display, and the building was fairly ablaze with light, both inside and out. The interior of the hall was beautifully draped with flags and bunting, and from every corner and at equal distances along the side walls wires were strung to the large chandeliers. These were covered with bunting, and at intervals of about a foot were arranged many colored incandescent lamps. Over the platform at the end of the hall, on which was stationed Hobbs' Orchestra, was a double revolving star, each point of which was studded with different colored lights, red, yellow, white, blue and green. As these spun round in opposite directions the effect was simply dazzling. At the opposite end of the hall was a large star and crescent similarly arranged, and on the side wall facing the main entrance was a panel containing the word "welcome," each letter of which was composed of different colored lights. Over the entrance was a clock encircled by white lights, and looking like an immense diamond against the dark background of flags. In fact, lights met the eye at every turn, and were arranged in series which permitted any color to be cut in or out at will. While the dancing was going on the room was wrapped in a soft twilight of constantly changing hue, and the effect was certainly charming. The details of the decorations were arranged by the members of the association, and the Edison Illuminating Company handled the interior lighting, while the Boston Electric Light Company looked after the exterior. Many prominent city officials and heads of the various departments were present, and well known faces in the electrical field were to be encountered everywhere. Taken as a whole, the affair was a great success, and those in charge may feel justly proud of the way their efforts were appreciated. H. G. T.

Boston, Feb. 4.

OUR CHICAGO LETTER.

A petition has been presented by the citizens of Hawthorne to the town board of Cicero, asking for better electric light service, which will no doubt be granted.

During the first part of this week pedestrians would have found it to their interest to have carried an Alpen-stock while walking the streets, in order to prod the slush on the crossings and ascertain its depth and consistency, but during the last two days, without ice skates or the corner lamp-post to help the unfortunate pedestrian, footing was most uncertain on account of the slippery condition of the walks.

The Calumet Electric Street Railway Company, this city, gave a trust deed Saturday, January 28, 1893, to the Jennings Trust Company, to secure the payment of $1,000,000 construction bonds and $250,000 improvement bonds, bearing six per cent., payable in gold. The bonds are of $1,000 each, payable in New York or Chicago, subject to call within ten years at 10 per cent. premium, after ten years at 5 per cent. premium, 10 per cent. to be deducted after September 1, 1893. The deed covers all the property and franchise of the road.

Personal.—George Cutter has gone East in the interest of his "Enamelite" rheostats and heating devices.—A. M. Searles was recently appointed manager of the supply department of the General Electric Company.—Mr. H. Cochrane, who will be remembered by many from his connection with the Electron Manufacturing Company, is now in charge of the Edison plant at Salida, Cal.—Dr. John McKinlock was recently appointed medical director in Chicago for the Commercial Alliance Life Insurance Company, of New York.

The Central Electric Company hopes to have its new catalogue finished by April 1, and begs the indulgence of its patrons, assuring them that they will be well repaid by waiting, as the book is expected to be the very finest in the catalogue art. This company received an order last week by telegraph for 30 miles of No. 4 weatherproof wire, the conditions of the accepting of the order being that it would be shipped on the same day. The order was filled out of its own stock, and the Central can be congratulated on being able to handle business of this magnitude in so prompt a manner.

The Manufactures Building at the World's Fair was damaged by a snowslide on Saturday last to the extent of $5,000. The snow covering 16 acres of the main roof broke away and had a clear fall of 50 feet, crushing through 300 feet of the roof of the East valley of the West annex, also a break 500 feet long in the same valley between the center of the southern part in the Western annex and the South end, together with 100 feet of the gutters of the main roof. The work of repairing the damaged portion will be commenced soon and pushed forward rapidly. M. J. B.

Chicago, Feb. 4.

A Reply from Mr. Lockwood.

To the Editor of Electrical Review:

I have read with interest the letter of Mr. M. N. Trapp, printed on page 289 of your issue bearing date of to-day.

An honest criticism is always, I think, worthy of consideration and reply.

It is not, however, "an open question" as Mr. Trapp supposes, "whether Dr. Bird or Mr. Bachhoffner should carry off the palm of priority of invention."

1. According to Mr. Trapp's own statement, and the authority he quotes, Dr. Bird's device of which he speaks was not the induction coil itself, but a "contact breaker."

This was a little electro-magnet, as Lardner says "with a wire core," but I do not think it had a core *made up of a number of wires*, as such a construction in a small electro-magnet would have been entirely without utility.

2. If Mr. Trapp will look on the page of Lardner opposite to that from which he quotes (*i. e.*, page 516) he will find this statement: "*Mr. Bachhoffner found* that a bundle of iron wires, as a core, gave much more powerful effects than a mere bar of iron. *Dr. Bird and others* adopted this plan."

3. Even in the words quoted from my papers and from Lardner by Mr. Trapp, the date given for Bird is October 14, 1837, while that assigned to Bachhoffner is October 23, 1837; nine days in favor of Bird; but it is to be noted that Bachhoffner refers to a former paper in which he had stated that the insertion of a bundle of wires in the axis of the coil increased its power two-fold.

And in the Annals, Vol. 1, page 496, is a letter from Bachhoffner, evidently the paper to which he refers, which Sturgeon states was received August 5, 1837, showing and describing the core made up of a bundle of insulated iron wires.

4. But although Bachhoffner was, with respect to Golding Bird clearly ahead, it is also true, as in my paper I state, that Sturgeon himself preceded both in developing the idea, and in publishing an account of it.

Truly yours,

Thos. D. Lockwood.

Boston, February 4.

Announcement to World's Fair Exhibitors.

To the Editor of Electrical Review:

Exhibitors in this department will confer a favor by supplying the following information at the earliest possible moment:

1. The number of packages in shipment of exhibits

2. The number of shipping labels required for the packages.

3. The number of shipping tags, if any, required for the packages.

4. Probable time of shipment of exhibits.

These tags and labels will be furnished immediately upon application, and the department urges upon exhibitors the necessity for early shipment of exhibits in order to avoid the inevitable rush of the last few weeks of the installation period.

J. P. Barrett,
Chief Dept. of Electricity.

Chicago, Ill., February 2.

PERSONAL.

M. Van Rysselberghe, the widely known Belgian electrician, died in Antwerp last week.

Mr. E. P. Meany, assistant general manager of the American Telephone and Telegraph Company, has been honored by Governor Werts, of New Jersey, by the appointment as his chief of staff. Colonel Meany will honor the position.

Mr. W. A. Kreidler, editor and proprietor of the *Western Electrician*, and Miss Netta O. Preston were married at Elgin, Ill., February 1. The Review extends cordial congratulations and best wishes. No one better than the hardworking editor deserves a charming wife.

Mr. J. Potter, of Cleveland, Ohio, for many years treasurer of the Brush Electric Company, has resigned and will look after his numerous other enterprises, many of which are electrical. Mr. Potter also resigns the presidency of the Short Electric Railway Company. Mr. Potter, though a young man, was one of the pioneer electric light men and is held in the highest esteem by all who know him, and in his changed work will receive the best wishes of everyone.

LETTERS FROM A LABORATORY.—XXXIII.

By Julian A. Moses.

Another excellent method for writing labels on glass bottles is that in which an electrically heated platinum wire is passed over the surface of the glass, and in its passage it chips off small triangular pieces. By this means the writing is perfectly permanent, but as this requires special apparatus it is not adapted to laboratory use.

Where a ground glass surface is used as a means of indicating the letters, they may be made more prominent by rubbing in some white, such as zinc white. The whole should then be varnished with pale shellac in alcohol.

The letters may be marked direct on the glass with finely ground zinc white mixed into a thin paint with some quick drying medium. This latter makes one of the most useful and ornamental labels, and if the medium is hard and adhesive when it is dry, the inscription will be practically permanent. For black writing there is nothing better than Brunswick black, which may be purchased under the name of asphaltum varnish.

A stock of labels may not be always convenient to carry, especially if they are required of different sizes. Where neatly cut and well formed labels are desired, a small piece of tin, bent to resemble the cover of a box with two adjacent sides removed, will serve as a form into which any convenient piece of paper may be put, and by simply cutting along the edges of the piece of tin, a rectangular shape may be obtained. Some prefer to purchase rubber stamps that will print a rectangle or other form, different colors being obtained by aniline pads. These stamps when pressed upon the paper produce a neat border, inside of which may be written or printed the required inscription. These must, of course, be cut out sharply, otherwise the desired effect will be spoiled. For writing labels, especially where the paper has not been glazed, ordinary ink will not do, as it spreads in the paper. India ink used with a flat nibbed pen is best suited for printing purposes. A sharp nibbed pen is liable to dig into the paper and cause the ink to spatter.

An excellent mucilage for pasting labels is composed of a thick aqueous solution of dextrine. In many cases it is impossible to make ordinary mucilage hold. A certain manufacturer of inks once had great trouble in making his labels stick to the tins in which he shipped his inks. Considerable experimenting with different kinds of mucilage failed to obtain a satisfactory adhesion between the paper and the tinned iron surface. One day it happened to strike him that the fault lay not in the medium but in the surface. Experimenting on this line produced the desired result and a slight rubbing with a piece of pumice stone on the tin, enough to roughen it, was sufficient to prepare the surface so that the mucilage adhered and his labels gave him no more trouble.

Labels may be put upon spheroidal surfaces without wrinkles by first wetting the paper and applying it to the surface while in this condition. Sometimes, depending upon the kind of paper, and the nature of the surface, the label adheres without mucilage. More often, however, the paper label must be removed, a slight quantity of mucilage spread upon the concave surface, and replaced upon the object intended to receive it.

Circular labels of different sizes may be cut from blank paper by using cutters made of pieces of brass tubing turned on one end in the lathe so as to make a sharp edge. These cutters may be kept in nests and can serve the double purpose of label cutter and cork borer.

Another material, excellent for labels, is sheet celluloid, which can be printed upon with Brunswick black, and may be cut in any desired shape with a pair of stout, sharp scissors.

Prof. E. P. Roberts, of the Swan Lamp Company, lectured recently in Association Hall, Cleveland, on "Arc and Incandescent Lighting." Prof. Roberts explained the system of electric lighting, which he illustrated with stereopticon views and also by a number of experiments.

Electrical Heating and Electric Metal Working.

AN ADDRESS READ BEFORE THE FRANKLIN INSTITUTE, JANUARY 18, 1893, BY GEORGE D. BURTON.

A year has passed since I accepted the invitation of your secretary to present to the members of this institution an outline of my system of working metals by electricity. At the close of my remarks, at that time, a gentleman in the audience inquired the cost of electric heat as compared with other well known methods of heating. As my experiments had not been conducted to that degree that would warrant my making a comparison, I replied that I did not know.

To night I am prepared to answer that question, and also to impress upon you the fact that heat produced by electricity, for the purpose of heating metals, as compared with coal, when all the conditions are equal, is 22 per cent. cheaper than heat that is produced and applied directly to the metal from coal; and, to verify this statement, I shall quote extracts from the report of Mr. George L. Harvey, the well-known mechanical engineer, of Chicago, Ill., who, after spending considerable time at our electrical works in Boston, making numerous tests, bases his report upon calculations from measurements obtained by accurate instruments, and reports as follows:

The heating apparatus has for its object—to heat a bar of metal of any size, or shape, up to the full capacity of the apparatus.

This is done by taking an alternating current of great force and small amperage, and transforming or converting it into a heating current of low electromotive force and greater amperage.

This current is applied to the ends of a bar or piece to be heated, and accomplishes the result in a minute or two. The devices attached to the transformer hold the pieces to be heated.

In the following I give three tests, which were conducted at my request, on October 24.

The tests were made to show the horse-power required to heat given sizes of bars under various conditions, from which the cost of heating the test bars could be calculated, and enable one to estimate the cost of heating different bars without an actual test.

The power in the generating room was provided by a 60 horse-power motor, with an Emerson power scale, so attached that the horse-power delivered to the dynamo could be determined at any time. Allowance was made for friction and power required to drive the generator when the transformer was not at work.

The tests are marked Nos. 1, 2 and 3.

Other tests, made previous to my work, are tabulated to give further data on which to base my conclusions. These, I understand, were all made by parties outside of the employ of the Electrical Forging Company.

I used, in making my conclusions, further tests, which show that:

1. The horse-power required to heat a cubic inch of material is independent of the length of bar—an unexpected result.

2. The horse-power required to heat a bar decreases very rapidly as the time of heating is shortened.

This is a peculiar result, partly accounted for by the fact that the radiating surface remaining constant, less heat will be lost by radiation, the quicker the piece is heated, and will, therefore, require a smaller "total heat or power" to bring a given bar to a white heat.

This fact is of great practical value, as the rapidity of heating determines the value of the heating plant; for, if 10 minutes were required to heat a bar in a forge and but one in this machine, you save $\frac{9}{10}$ of the total time of not only your machines, but your men.

In working pieces in a forge, several reheatings are sometimes necessary, while, with work heated by electricity, it cannot be doubted that a less number of reheatings would be required. This saving of time, amounting to several per cent., must be added to the saving, shown below, for the electrical heating process.

3. That pieces protected from the air while heating require less heat than when exposed, which would be naturally supposed.

Below I give an estimate on a 600 horse-power plant, which, according to a bid made by the Electrical Forging Company, is capable of heating a billet 1x8x36, containing 288 cubic inches, in one minute to a working heat.

These figures are given by them: Cost of plant, $22,500; interest, $1,350; repairs, four per cent, $900; coal at two pounds per horse-power at $1.25, $2,250; man to run generator, $900; helper for heating on transformer at $1.50, $450. Total yearly cost, $5,850. To which must be added the power plant for running the main generators.

The price of blacksmith coal used in the estimate, $1.65, is as much lower than the market as $1.25 per ton for slack coal to be used under the boilers. This was done to make the estimates for coal and the comparison on the same basis.

Engines, 600 horse-power boilers, pumps, heaters, piping, stack, shafting, power house, $39,000.

Yearly cost—Interest on $39,000, $2,340; engineer, $900; fireman and helper, $1,800; assistant engineer, $700; insurance, $400; ground lease (?); repairs, $2,000. Total yearly cost, $8,140; power plant, $5,850. Total, $13,990; or, $14,000.

Total daily cost, $46.66; or for 600 minutes, viz., a day at one billet per minute, 7.78 cents.

The cost for heating a billet by coal in a shop would be as follows: Billet, 1x8x36, 288 cubic inches; weight, 80 pounds; coal required, 36 pounds at $1.65, 2.52 cents.

The time required for heating this bar will be about 10 minutes longer than the electric process, which will require, as claimed, one minute. Then we must add to cost of heating by coal—10 minutes: One smith at 30 cents, 5 cents; one helper at 15 cents, 2½ cents. Total cost for heating by coal one 80 pound billet, 10 cents. Total cost by electricity, 7.78 cents. Gain, $2.22 cents.

If the two helpers were required, the cost of heating billets would be, by coal, at $1.65, 12.5 cents; by electricity, 7.7 cents. Saving, 4.8 cents.

Saving of electricity over coal of 40 per cent.

The electric heat acting as it does from the inside and extending outward, heats a bar in a far superior manner to any external heating, even if the external heat is free from sulphur or dirt.

The central core, if required can be heated to a liquid state, and retains heat longer than if it is heated by an open fire.

The electric method has the advantage, that the heat can be applied while the bar is being forged.

The piece is always in sight, and loss of work by burning would be very rare, if not impossible.

Pieces can be heated without removal from the anvil at least more than a few inches.

The heat can be applied to just the part desired and no other, a great saving in power.

The loss of iron by oxidation is very slight and is given as about $2\frac{1}{10}$ per cent. when bar is heated in air, and $1\frac{1}{10}$ per cent. when heated under some protection.

It must be obvious that a quick heat will cause less oxidation than a longer one.

The temperature can be regulated to any desired degree, from nothing up to melting, and held at any point as long as practical working would call for.

In tempering, bars can be brought up to a given predetermined heat by setting the regulator in a certain position, for the heating of a number of pieces as long as the power remains constant.

In addition to this report, and before the close of my remarks, I shall present to you upon the screen, in connection with other illustrations of my system, some figures showing the results of numerous tests of heating by our process, computed by F. H. Crane, S. B., mechanical engineer of the Emerson Power Scale Company, of Boston.

All of these tests were conducted, and the

VIEW OF NEW FACTORY OF THE GREAT WESTERN MANUFACTURING COMPANY, DULUTH, MINN.

figures giving the results were determined by Mr. Crane. In some of these, the results of which I shall show, you will observe that our apparatus heats long and large bars of metal evenly the entire length, using less than four horse-power per cubic inch of metal heated per minute, and, as I am informed by some of the iron and steel manufacturers of your State that the heating of metal by coal requires a consumption of fuel equal to produce four horse-power per cubic inch of metal heated per minute; therefore, without making further statements, I believe that I have clearly demonstrated to you that heat produced by electricity, for heating of metals, is cheaper than any other method.

In addition to the saving in cost of electricity over coal, there are many features in favor of the electric process—the absolute control of the electric current while the metal is heating large or small pieces; economy in time and labor; no attendant required to maintain the forge fire; no smoke or dust, therefore, no ashes to be removed; cleanliness about the workshop; no coal to be carried to the forges; more floor space to be utilized; on account of the less number of forges necessary to perform the same work, the usual intense heat about the workshop is dispensed with; as electricity is free from all gases, none are introduced into the metal while heating; uniformity of the heat throughout the entire piece or pieces, either large or small, if within the capacity of the machine; the possibility of accomplishing results at one heat, by the electrical process, which it is impossible to obtain with three or four heats by ordinary methods; the saving in scale of from five to seven per cent., as only one scale is lifted, that which is on the bar when it is first formed.

Instead of having many machines in the shop, for the purpose of working bars of varied dimensions, one machine, constructed upon our principle, will meet all the requirements within its capacity, by simply changing the metal holders, for holding pieces of different lengths and shapes. Why this is so, occurs in the ability of the operator to absolutely control the electric current, so as to heat a three-eighth inch wire, or a bar two inches square and three feet long with the same machine. This all can be done by our apparatus, because the transformer is so constructed that it calls upon the generator, through the medium of the regulation of the exciter current, for what power is wanted, as it is adjusted so as to automatically force the generator to furnish just what current is called for by the transformer, so as to heat a three-eighth inch wire three feet long, or a steel bar two inches square and three feet long. The automatic regulation of the current which is consumed in heating different sized pieces with the same size apparatus is of importance, and I believe the system we employ for doing this is the first in the field. The question undoubtedly will suggest itself to your minds as to whether or not some other combination of electrical devices, similar to those we employ, would not produce the same or superior results. We have made many different combinations and connections, some of which worked fairly well, but none proved as successful and economical, and gave such good results, as the system which I will illustrate and describe to you later.

As soon as a bar of metal becomes thoroughly energized by the current, the particles, or molecules composing the piece under heat, begin to move within the outer skin or surface which is on the piece when it cools after leaving the rolling or forming machine when first shaped. As soon as the action of these particles take place, they move one against the other with great rapidity, and in proportion to the number of pulsations of the current. The rapid movement of these particles create heat, and assists the heating process until the molecules reach a liquid state. As the bar becomes hot there are no molecules to be agitated, and more power is required to force the current through the bar from this point to melting. This is one of the reasons why hot metal is a poorer conductor of electricity than cold. We find that if the bar has been properly heated and then subjected to pressure by the rolling process, or to a succession of hammer blows, its character is changed for the better, the grain or fibre of the metal is improved.

I have some samples here which show that the inside of the bar has been in a perfectly liquid state, while the outside remained apparently unheated. This is caused by the action of the atmosphere upon the piece while heating, as the air acts upon the exterior and keeps it cooler than the interior, which has led some to believe that the interior was heated first, and that the current passed upon the inside of the bar and heated that portion first, the internal heat being radiated outward. We have discovered that such is not the case, for, if the bars heated under cover, or some protection where the air is nearly excluded, the piece will heat in much shorter time, and will be evenly heated all through, and, if so heated, the piece retains the heat about four times as long as when heated by coal, and this is the reason we are enabled to do, with one electric heat, that which now requires three or four heats by other methods. I have here a steel hammer, made as you see it, all complete, at one heat. Three, and sometimes four, heatings are required, when the ordinary process is employed, to bring the article to this state of perfection.

Our experiments have proved that an absolutely perfect contact of the metal with the two poles or source of the electric current is not essential—also that it is not necessary to clamp the piece or pieces to be heated. As the weight of the rod or bar bearing upon each electrode is sufficient to complete the circuit through the plate or blank, which, being of greater resistance in the path of the current than the conductors or metal holders, is heated in a very short time.

In connecton with our apparatus, if the rheostat is introduced into the circuit leading to the fields of the dynamo from the exciter, we fail to get a current which will heat the bar evenly, as it would if placed as I shall show you. If this connection is used the heating of the bar at the ends, or parts nearest the electrodes, is always visible in advance of the heating at its middle part, so much so that an even heat is not attained by the direct action of the current upon the bar. This we attribute to two causes: First, the heating of the rheostat itself, as the work goes on, and, secondly, to the failure of the exciter to respond to the reaction of the heating of the bar upon it. When the rheostat is set to regulate the heat in the bar or bars by a certain amount of resistance in a cold state, the heating of the rheostat will cause it to present a different degree of resistance, varying constantly as it heats. This destroys the regulation of the current to a predetermined degree, and prevents the result being attained with certainty; but what is of more importance is the discovery that the process of heating the bar through the medium of the converter reacts upon the exciter-current, with our arrangement and connection of the machines, substantially corresponding to the condition of the bar. Thus, when the bar is introduced into the converter electrodes cold, the voltage of the exciter-current, in proportion to its amperage, rises with the heating of the bar, which undoubtedly causes the converter to give out a current of greater energy, in proportion to its volume, continually as it is needed to overcome the increased resistance of the bar, due to its heating. Thus, the action and reation of the exciter upon the bar, and the bar, while heating, upon the exciter-current, insures the continuing of the heating process until the bar is raised to an even working heat. On the other hand, the introduction of the rheostat in the direct circuit leading to the field-coils of the dynamo prevents the voltage from rising, with relation to the amperage, because in this position the rheostat itself is an obstruction to the current which energizes the fields of the dynamo. We, therefore, conclude that no resistance in the circuit of the converter, primary or secondary, or in the main circuit of the exciter, which obstructs the current and heats or warms up under its action, should be permitted, and that the energizing influence of the exciter, in producing a current of greater energy, in response to the increased resistance of the bar as the latter heats, which current can be regulated at will of the operator, depends upon the placing of the rheostat as we use it in the exciter field-circuit.

By our arrangement of mechanism, as above described, we have produced a heating current of electricity, having its voltage varying, with relation to its amperage, in such proportion that it can continue to heat the bar of metal until it brings its middle part to an even working heat with its ends first heated, without, in the meantime, heating those ends above that heat, so as to injure the metal. Moreover we regulate this current so as to bring the bar to any degree of heat desired for working it, as is required in the ordinary operations of working metals at the forge. We thus extend the application of heating metals by the electric current in new directions, and are even able to work some metals hot which have never before been worked in that way.

Our heating-current, which acts on the bar, is capable of being regulated so as to adapt it to different sizes and lengths of bars, and to the different resistance of the same sized bar when made of different metals, or of different grades of the same metal. We can adjust our regulator to vary the current to suit the size of the bar, as not to unduly heat or destroy one part of it before another is heated to the right point. Thus a current of electricity which would properly and evenly heat an iron bar three-fourths inch in diameter and six inches long would burn and injure the ends of a bar of like length and only one-half inch in diameter, if used otherwise than as above described.

One part of our invention may, therefore, be summed up as consisting of the discovery, when the primary and secondary circuits of the converter and the field-coil circuit of the dynamo are freed from heating resistance, which will interfere with the current, and the rheostat is so located as to not interfere with the current, but to regulate the exciter and cause it to give out its current of varying intensity proportionate to the work to be done, that we produce a governable current which will automatically maintain such relation of its voltage to its amperage, as the metal-heating progresses, so as to heat the metal to a substantially even working heat in all the part through which the current flows.

By forming the conducting rings of the converter continuous, they not only form a double conduit for the electricity from the respective terminals of the secondary coils attached to them, but they also induce currents of opposite polarity in each other, respectively, when the circuit is completed by the insertion of the bar, or bars, and thus inductively reinforce the current delivered to them by the converter, since the current will be flowing continuously around each endless ring. It also appears probable that these continuous endless rings, and the continuous annular core inside of them, act and react upon each other by induction, and also upon the circuits of the dynamo, and also of the exciter, to vary and regulate the potential of the current delivered through the bar, or bars, as it is required, furnishing a current of lower potential and greater heating power, when the heating of the bar or bars is begun, and the resistance is comparatively low to the passage of the current, and furnishing a current of higher potential as the piece or pieces become heated, and their resistance increases and more electric energy is required to force the current through them, and, by this alternate weakening and strengthening of the potential of the secondary current, as required, the heating effects are accomplished, and can be continued until the pieces are melted.

The excess current required is equivalent to the small proportion of the electric current which is demanded by the bar which first becomes heated. Our method of successively heating several bars in metal holders applied to the same converter also enables the workman to be performing his forging while several other pieces of work are successively being heated.

The variations in the potential of the secondary circuit are believed to correspond with the greater or less resistance of the iron in the different atages of heating, and it is also accomplished by a corresponding variation in the potential of the primary working circuit of the alternating dynamo—that is to say, when the secondary current of high amperage is flowing with the greatest ease through the bars, the voltage of the working-circuit of the alternating dynamo and that of the exciter-circuit are reduced—but, when the resistance of the bars becomes greater, checking the flow of the great volume of current in the secondary circuit of the converter, the voltage of the dynamo-current increases, the dynamo itself being run at the same speed continuously throughout the whole operation.

Again, the fact must not be lost sight of that a large mass of metal, which has possibly taken, say, a consumption of coal

equal to produce 1,000 horse-power to bring it to a forging condition, when once at that heat, would only require perhaps one-tenth part of such power to keep it at that forging heat as long as it might be required for the shaping machine to operate upon it, by which means we do away with the necessity of carrying it backwards and forwards to the furnace for reheating purposes.

Let us now consider the heating of a small piece of metal in, of course, smaller furnaces —for example, a bar of steel one inch square and 12 inches long. If a bar of this size be brought to a forging heat in the ordinary way, the furnace must be first got to a certain heat, after which the bars are inserted, but only a portion of the surface of the fire, perhaps, is taken up by said bars, and the remainder of the fire is practically, for the time being, wasted. By our electrical process a bar of metal one inch square and 12 inches long can be heated at a cost of something like one-half a pound of coal in 40 seconds, because the whole of the heat coming from that quantity of coal is concentrated upon this particular bar for the time being, viz., 40 seconds.

In determining the possibilities of heating and working metals by our system, we have used a 50 and a 75 horse-power apparatus. All of our tests have been made upon these machines, and we have found, when heating large pieces, the largest of which was four inches square and three feet long, that the larger the bar the greater the economy in heating, because there is a saving in the radiation of the heat, and we also find that when a bar contains, say, 150 cubic inches, it requires less electrical horse-power to heat it than is required to heat the same number of cubic inches if divided into several smaller bars. Why this is so, we believe, is owing to the fact that all of the electrical energy is concentrated upon the larger piece, which leads us to believe that it is possible to heat, by electricity, very large pieces of metal successfully and economically, and that, within the next six months, we shall show a greater saving than what I have been able to present to you to-night, at which time we shall have in operation in Chicago a 1,000 horse-power plant capable of demonstrating whether or not the foregoing conclusions are correct.

I will now illustrate and describe, by the aid of the lantern, 50 different views, showing our electrical apparatus and its connections, together with the various devices and machines used by us in the heating, handling and working of metals by electricity.

What Is Electricity?

BY S. F. WALKER, IN THE LONDON "ELECTRICAL ENGINEER."

The rapid advances that have been made during the past ten years, both in the practical application of electricity to the service of man and in the knowledge of the principles of the science, have brought us, in the writer's opinion, to the point at which we are obliged to ask ourselves, What is electricity? if the advance is to continue. Up till very recently, notwithstanding the wonderful guesses that have been made by those not actually engaged either in the study or the practice of electricity, and the closer and closer approximations that have been made by those mathematicians who have given attention to the subject, it may fairly be said that we knew absolutely nothing as to what the mighty force we dealt with was. And, in addition to this, it has not been necessary that we should know what electricity was, so long as we were thoroughly cognizant with what it could be made to do.

Prof. Oliver Lodge first aroused us from this peaceful state when he commenced his crusade against lightning conductors. Those of us who had studied the subject closely felt that Dr. Lodge was wrong, and we believe that in the battle at Bath we successfully defended our position, but it was only by making use of an argument that is always in the mouth of the old type of practical men, and which was therefore dangerously close to the feminine argument—it is because it is. We could not go further because we were lost, literally and metaphorically, immediately we got up in the clouds. What is a charged cloud? occurred to one again and again, and one was not satisfied with the old stereotyped answer that the cloud formed one plate of a condenser.

Since the battle at Bath, the writer of this article has been closely observing every circumstance that appeared to bear upon the question, and he has devoted a considerable amount of time to the purpose of thinking the matter out step by step, but it was not until after listening to the lecture delivered by Prof. Rücker before the British Association on "Electrical Stress," and after careful thought had enabled him to realize the full force of the experiments so ably conducted on that occasion, that the result, which he now ventures to state, dawned upon him. As far as the writer is able to understand the matter now, electricity is simply motion of the molecules of the different substances which are the subjects of electrical action, just as heat, light and sound are, and the only difference between these forces is the rate of the motion. The motion of sound, as we all know, is comparatively slow; that of heat and light are very rapid. That of electricity would appear to be somewhat between the slow motion of sound and the rapid motion of the heat-waves, whose motion is slowest. And it would appear that the wonderful adaptability which electricity shows for every kind of work is due entirely to the position which its rate of motion occupies in the scale of the energies. It would also appear that the reason this wonderful agent laid dormant for so many ages, and is even now only partially developed, is very largely, at any rate, because we have no sense which responds to the particular periods of vibration comprised within the electrical range.

As already pointed out, Prof. Rücker's experiments showing clearly that the dielectric in an electric condenser is compressed by reason of the charge which is present at the surface of the condenser plates, puts the keystone to the arch which is built up of the principles of the science; but once the principle is accepted, it will be found that every known electrical phenomena can be explained by its use, and that many phenomena that have hitherto appeared very puzzling become quite simple when interpreted by its aid. The limits of this article will not allow of illustrations being given, but the writer hopes to return to the subject again, and will then go more fully into details. The writer's reason for referring to the evidence afforded by Prof. Rücker's experiments as so conclusive is because this fact of the increased size or altered form of any body when subject to the strain of one of the other physical forces has always been, and justly so, the grand argument in favor of the principle that these other forces were merely forms of motion within the bodies themselves. One of the greatest difficulties, in fact, in approaching a subject of this kind is to train the mind to realize the invisible motion of the molecules of a body in each case. With sound, for instance, we may cause a bell or a tuning-fork to sound their proper notes, yet it is only by the application of special apparatus that we are able to show that these bodies are not only in motion, but actually change their form when emitting sound; so, too, with heat. It is exceedingly difficult for us to realize that an iron bar is in motion within itself, even when what we call cold, yet it is not difficult to prove that every substance alters its form under the influence of heat, expanding as heat is applied, contracting as heat is taken from it; and that the different states in which bodies exist—the solid, liquid and gaseous—are due to the different spaces required by the molecules in their vibrations, and, therefore, to the different rates of their vibrations. As in all these cases it has been shown that change of form, increase or decrease of the lineal dimensions of any body under the influence of sound, heat, or light, can only be due to the increase or decrease of the rate and amplitude of the vibrations of the molecules of the body within itself, so the fact that the dielectric of an electrical condenser is compressed when the condenser is charged can only be due to the increased dimensions of the condenser plates from the vibrations set up within the plates themselves by reason of what we know as the electrostatic charge. Electric currents, of course, are merely the communication of these motions from one body to another; those bodies such as the metals in which the molecules are more easily able to take up the motion forming what we call conductors, and those which do so with difficulty being insulators.

The writer will conclude this brief notice by remarking that heat currents would be far more efficient than electric currents if we could make use of them as we do the latter, and that, as he before remarked, the reason electricity is such a useful agent appears to be because its rate of vibration is sufficiently high to admit of rapid transmission, yet not sufficiently so to be destructive. It only becomes destructive when it is transformed into heat.

Fig. 1.

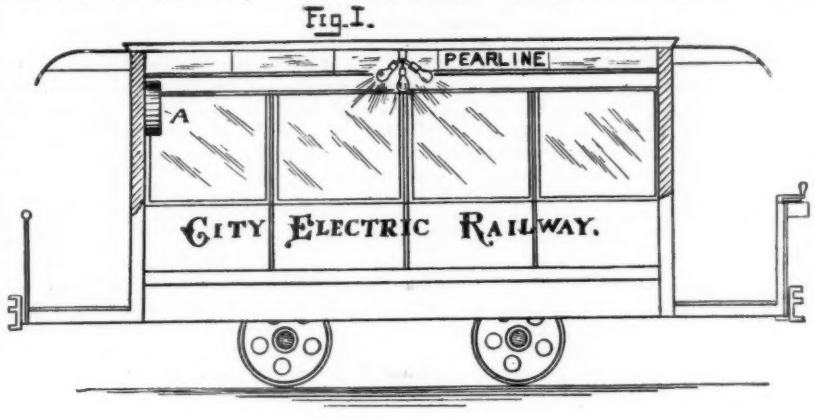


Fig. 2.

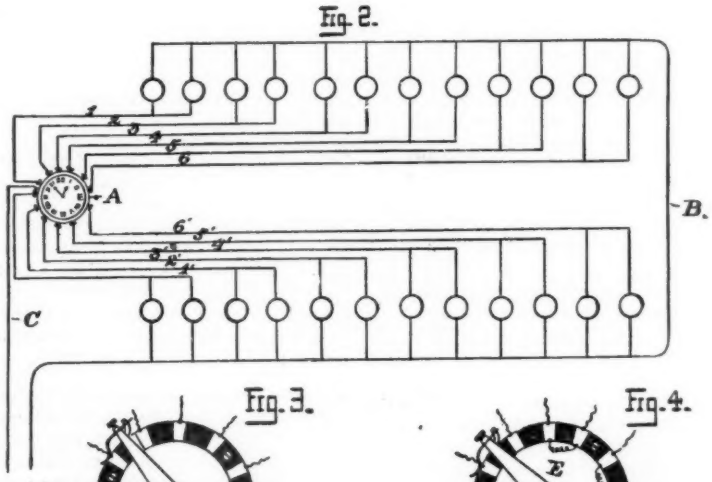


Fig. 3.

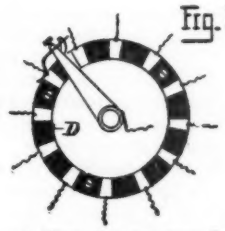
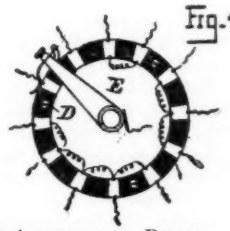


Fig. 4.



A NEW ADVERTISING IDEA.—ELECTRICITY AGAIN TO THE RESCUE.

Electrical Advertising.

A novel and clever system of advertising has been designed by Mr. H. T. Richards, the advertising manager of the ELECTRICAL REVIEW. The system comprises a number of incandescent lamps mounted behind translucent panels of ground glass or other material on the side walls of street cars or elsewhere where the advertisements may be displayed, and a system of circuit connections with a circuit controller by which current may be fed to the lamps behind the several panels, in such a way that only one advertising card will be illuminated at once. The advertising devices may in some cases comprise perforations in an opaque panel, such as sheet metal or some other material, behind the glass front of the advertising panel, so that when the incandescent lamps are aglow the advertising matter will be rendered luminous by the transmitted light. Various colors may be given to different parts of the advertising card by a suitable arrangement of colored glass. By the operation of the circuit controller, which may be an ordinary clock provided with suitable contact making disks, the lamps are cut into circuit in any desired order, so that a panel for a minute or longer period, if desired, may be illuminated on one side of the car and then extinguished by the action of the circuit controller, and after a lapse of any suitable interval, another advertisement will flash into view in some other part of the car. The current may be furnished by a storage battery mounted on the car, or, in case of trolley lines, may be supplied by a shunt from the motor containing suitable regulating devices.

The accompanying engravings illustrate the operation of the system, Fig. 1 showing a partly sectional view of a car equipped with this system, in which the advertisement "Pearline" is shown displayed, the other cards exposing simply a glass surface, the back of which is rendered substantially opaque by being ground, and, therefore, but one advertisement can be read at one time. Fig. 2 shows a diagrammatic view of the circuit connections where groups of lamps, as shown, two being used for each panel, are successively cut into circuit by the action of a circuit closer operated by a clock. Figs. 3 and 4 show in detached views the action of the switch, which is simply a rotating arm mounted upon a minute hand of the clock, and which sweeps over a circumferential row of contacts connected with the respective leads to the groups of lamps which illuminate the several signs.

A Handsome Factory.

In the REVIEW last week mention was made of the new factory of the Great Western Manufacturing Company which had been purchased at Duluth, Minn. In this issue is presented a bird's-eye view, and a very fine looking and extensive establishment it is. This company takes over the business of the Great Western Electrical Supply Company, of Chicago, E. R. Gilman, manager, and other companies, and will soon be well housed for doing a large business.

The Trolley.

[*Norristown, Pa., Times.*]

In nearly every progressive locality the trolley system now either exists or is spoken of as one of the improvements in the near future. Just as sure as the trolley is spoken of some persons can be found who are opposed to the system. If the matter is sifted it will generally be discovered that there are some mercenary or personal objections to the opposition; possibly the grumbler has some stock in old style motors which might suffer if something more improved is introduced.

Danger from the trolley! They never speak of the great dangers in steam locomotion. They have become so used to traveling by steam that they never realize how near is eternity, if something should happen. There is far more danger in a broken rail than in any broken trolley wire.

JOURNEY JOTTINGS.

THE ST. LOUIS ELECTRIC CLUB—BIG ELECTRICAL CONTRACTS—TELEPHONE MATTERS—THAT 100-MILE-AN-HOUR ELECTRIC ROAD.

(*Special Editorial Correspondence.*)

ST. LOUIS, Mo., February 2.—The number of electrical people who have made themselves prominent in the rotunda of the Southern Hotel during the past few days would lead one to believe that the convention of the National Electric Light Association had commenced ahead of time. The sweet morsel which attracted was composed of several large contracts which the Lindell Railway is expected to award to-morrow. Among those on the ground are General Manager Lemuel Bannister, of the Westinghouse Electric and Manufacturing Company, who arrived this morning. He is accompanied by Messrs. Atkinson and Pantaleoni. Mr. Elmer P. Morris, of the General Electric Company's railway department, is also in evidence. Mr. William Hazelton, 3d, the general manager of the Short Electric Company, of Cleveland, Mr. F. A. Wunder, of the Chicago office of the Fort Wayne Company, Mr. J. H. Mason, general manager of the Simplex Electrical Company, of Boston, Mr. Wm. S. Hine, of the J. T. Case Engine Company, Mr. A. A. Hayden, general manager of the Law Battery Company, New York, Mr. Taylor, of Taylor, Goodhue & Ames, Chicago, Mr. J. I. Gulick, of New York, and Mr. Thomas G. Grier, Western manager of the Bryant Electric Company, are also among the electrical visitors present at this time. Mr. W. A. Smith, the general manager of the Omaha Street Railway Company, has been in town for a day or two, and it is understood that he is intending to make some important purchases for his road.

The St. Louis Electrical Exchange held its January meeting and installed new officers on Saturday evening, the 28th. A banquet was held which was followed by a pretty gay time generally. Mr. E. T. Cooke, formerly secretary of the exchange, is the new president, and in his inaugural address endeavored to stir up the members of the exchange to take a more lively interest in its affairs. The first annual banquet was held in the Merchant's *café*. A number of speeches followed the coffee and cigars, among the speakers being President James I. Ayer, of the National Electric Light Association, who addressed the exchange on "Electric Light and its Progress." On the banquet table were placed some candles and a coal oil lamp, for the purpose of contrasting antique methods of illumination with the light given forth by the incandescent lamps in the *café*.

Professor George Forbes, of London, will be present at the St. Louis Convention of the National Electric Light Association. President James I. Ayer had a letter to-day from Professor Forbes' private secretary, which gave this information. It is probable that Professor Forbes may read a paper before the convention.

The overhead wires in St. Louis have been put to a severe test during the last two or three days in passing through a prolonged sleet storm. The wires, exposed to the elements, are covered with ice, but as yet no breaks of any consequence have been reported.

Telephone matters in St. Louis are becoming quite interesting. The Telephone-Telegraph Service Company, which proposes to become a rival of the Bell Telephone Company, of Missouri, has asked the Secretary of State for articles of incorporation, and declare that they will begin furnishing service soon after March next. They propose a $60 rate for business houses and $50 for residences. Service will be carried on through conduits. The present capital stock is fixed at $25,000, with a privilege of increasing to $1,000,000. It is said that 1,000 subscribers have been promised the new concern. The present stockholders in the enterprise are Dr. A. V. L. Brokaw, Turner T. Lewis, John M. Sellers, Charles T. Farrar, Robert McLaren, Bradley D. Lee, Hugh Rogers and George R. Mann.

The stockholders of the Adams Electric Railway Company, according to a representative of that concern with whom I recently had a conversation, feel hopeful of ultimately gaining their suit against the Thomson-Houston Company, on basic electric railway patents. As an evidence of this confidence, it is stated that the latest sale of stock in the Adams Electric Railway Company was at a price of $750 for stock of the par value of $100. How true this is I cannot say.

I met Mr. George F. Steedman, who is connected with the Chicago and St. Louis Electric Railroad Company, at the Electric Club the other day and had a very pleasant half hour's chat with him in regard to the proposed "through by lightning" scheme. He told me that he had just received a telegram which informed him that the bill which his company has before Congress, to allow it to import electrical apparatus free of duty, would come up for a special hearing some day this week before the Ways and Means Committee, and he had hopes of the ultimate passage of the bill. Talking about the railroad scheme, Mr. Steedman exhibited great enthusiasm and seemed perfectly sincere in his convictions regarding the intentions of the company and the ultimate success of the enterprise. He said he had no idea that the road would be finished in time for the World's Fair, as only 26 miles of the route have been graded as yet. The rights of way from East St. Louis to Chicago proper have nearly all been secured and without a cent of expense to the railroad company. This rather curious fact was explained by Mr. Steedman who said that the town-site privileges along the line of the road were very valuable, and that whenever town-site companies were organized for the purpose of developing the land adjacent to the railway line, one-half of the capital stock of the town-site company was turned into the treasury of the railway company as a thank offering for the blessing conferred by running the railway line through the town site instead of around it. Mr Steedman now estimates the total cost of the Chicago and St. Louis line at $8,000,000. The electric contracts are not yet placed. The Westinghouse Company, Mr. Steedman said, offered to build all the electrical apparatus required for the road on the basis of a cash contract. This proposition was declined because the railway company desires to make contracts by which one-half is paid in cash and one-half in the bonds of the company at par. This is desired, it is explained, so that the manufacturing company which will be thus so intimately connected with the railway company will lend the stamp of its approval of the enterprise by showing sufficient confidence to take bonds at par as half of its compensation.

During the past week contracts have been let for the complete work of grading, bridging and track-laying for the road. The contractors are Bagnell Bros., of St. Louis, and Garvey Bros., of Memphis, both wealthy and reliable firms. The contractors are to accept one-half of their monthly estimates in the bonds of the company at par, settlements being made every month. The contractors have admitted the truth of the above, but have declined to talk. Payments on these contracts will take up about two millions of the bonds.

"As long as I am president of the St. Louis Electric Club," said Capt. Robert McCulloch as we tested some of the new easy chairs which the club has just purchased, "the expenditures will never exceed the receipts. We are tackling the problem of establishing an electric club in St. Louis on business principles, and when we find that won't work we'll just quietly shut up shop and quit."

As long as the Captain is at the helm, at least, the St. Louis Electric Club is destined to progress. Capt. McCulloch is one of the busiest men in St. Louis and yet he finds time to keep things on the hum at the new club. He is general manager of two cable roads and one electric railway and the syndicate which he represents is converting three horse roads into trolley roads. In spite of these severe demands upon his time, Capt. McCulloch is ever ready to impart information or help along a good cause. He has been a street railway man for more than 20 years and claims to know a little about the business.

There is some talk of the Engineers' Club and the Architects' Club, of St. Louis, forming a friendly alliance with the Electric Club. None of the three organizations will lose its identity, but, by the other two clubs securing adjoining rooms to the Electric Club in the Equitable building, one *café* will serve for all three, and other desirable ends can be attained which will be mutually advantageous. Members of all these clubs are desirous of seeing such an arrangement consummated, and it is probable that it will be.

The Electric Club is working hard to prepare the way for delegates to the convention of the National Electric Light Association next month, and many satisfactory plans have already been arranged. A special meeting of the Club was held on Wednesday, January 25, at which Captain McCulloch presided. The committees appointed on Saturday reported progress, and there was considerable enthusiasm among those present. Messrs. Goodman King, C. R. Scudder, W. L. B. G. Allen and James I. Ayer were appointed a committee to prepare invitations and programmes for Nikola Tesla's great lecture and demonstration, which will be the leading event of the convention. Messrs. Gaiennie and Nahm were appointed a committee to consider the most desirable place for holding the banquet which will be tendered the visitors, and Messrs. Nathan Frank and Gaiennie were appointed a committee on literature and toasts.

"I account for the downfall of the New York Electric Club," remarked President James I. Ayer, of the National Electric Light Association, "by the simple fact that you New Yorkers made it an uptown social club. Had you organized a down-town commercial club or business exchange for electrical people, as we are doing here in St. Louis, your club would have been alive to-day."

The Broadway cable road in St. Louis is one of the model cable lines in the country. The cars of this road make 565 trips a day and every time a car makes the circuit of the road, the gripman must let go the cable 18 times when crossing other cable lines and in changing cables at the power houses. This gives 10,170 chances a day to cripple the entire service of the road, for if a gripman fails to let go the rope at just the proper minute his cable is cut and there you are with the whole line dead. The personal equation in the operation of a cable road thus is shown to be enormous, and far beyond anything of the kind encountered in running a street railway on the trolley system.

The Hon. Tom. L. Johnson, the statesman and street railway king, of Cleveland, Ohio, was at the Southern Hotel last week. A personal inspection of this gentleman's classic features shows that the political lithographs of him, which we all saw during the street railway convention in Cleveland last Autumn, were good and true counterfeits.

Several of the cross-town street railways in the city operate bobtail cars dragged by two mules. These mules will amuse Eastern delegates to the electric light convention who have never seen them before. They (the mules, not the delegates) are about as big as good-sized Newfoundland dogs, and the loads they can get away with will make the bibulous people envious. Some of them have been in active service for 10 or 12 years and look good for as much more. They will soon be released from bondage, however, as the days of the bobtail car in St. Louis are numbered.

I came here expecting to find that the enthusiasm over the "through by lightning" railroad to Chicago was beginning to die out, and that the enterprise was beginning to take the down grade that so many other big schemes have pursued before.

I was surprised to learn, after many inquiries among leading business men, that there were very few scoffers, and that many people of solid financial standing had purchased stock in the road and fully expected to realize largely upon it.

While the evidences of actual work accomplished consist solely in grading 36 miles of the proposed route in the vicinity of Edinburgh, Ill., about 80 miles from St. Louis, and while none of us have yet seen the plans of Dr. Adams' electrical equipment, the fact that a large amount of stock has been sold to business men in St. Louis and Chicago (which, it is asserted, has placed the company in an independent position), when considered with the fact that two such prominent railway contracting firms as Bagnell Bros. and Garvey Bros. have undertaken to build the road, leads the seeker after truth to the belief that there may be something in the scheme, after all. The impression which Dr. Adams left in New York, after his address describing the plans for the road at the Electric Club, was far from flattering. It seems he has fared better in St. Louis, where the majority of the people express confidence in his ideas. One of two things is certain—either the Chicago and St. Louis Electric Railroad Company is a gigantic fraud of a very common type, or it is a business enterprise which is bound to succeed. I have yet to learn of any eminent success which Dr. Wellington Adams has achieved, and which would lead to confidence in his successfully carrying out plans of great magnitude. On the other hand, the facts related above lead one to feel at least the symptoms of confidence in the road. I would suggest that, for the sake of the good name of the enterprise, the protection of the present holders of stock, and as an aid to the ultimate success of the road, Dr. Wellington Adams and his associates make a frank statement, through the press, of the exact financial status of the company and its affairs. This should be accompanied by detailed plans of the electrical apparatus, if any plan has been decided upon, and if the road has no definite ideas in this respect, the fact should be stated and engineering talent should be invited to compete. Whichever way the cat may jump, the failure or success of the Chicago and St. Louis Electric Railroad Company will have a marked effect on electric railway development. I think every member of the electrical fraternity is interested, to a greater or less degree, in the progress of this road, and as confession is good for the soul, Dr. Adams should step forward and make a speech.

STEPHEN L. COLES.

The Passing Away of the Electric Club.

The closing scenes at the Electric Club, of New York, were enacted to the jingle of the auctioneer's bell, the waving of his red flag, and the supplications "five, make it ten, ten, make it fifteen, going, going, gone," of the clear-voiced man with the auctioneer's hammer. Tuesday of last week was the date of the sale, and about $4,000 was realized from it. The sale was ordered by Henry D. Lyman, trustee of the bonds of the Club. The bulk of these bonds were donated to the Club and cancelled, nearly all of those remaining in force belonging to individuals who had taken them in payment of supplies. It is thought that they will realize about 50 per cent. of their claims.

But few electrical men were present at the sale. The magnificent electroliers in the parlor were purchased by Mr. H. C. Miner, the theatrical manager, for the foyer of one of his theatres. The Engineers' Club bought the fine hall electrolier, and Mr. H. J. Smith, of the Edison Illuminating Company, purchased the unique wrought iron fixtures that adorned the dining room. The electrical fixtures brought about 20 per cent. of their original factory cost, and included in each case the beautiful globes, many of cut glass, a gift to the Club of the Phœnix Glass Company.

ADVANCE INFORMATION.

New Electric Companies Formed and Important Constructions Projected.

VALUABLE INFORMATION FOR MANUFACTURERS AND DEALERS.

We publish below the earliest information obtainable relating to new electric railways, new electric light companies and projected electric construction of all kinds. Every reader will find these columns of special interest, and manufacturers and supply houses will receive many valuable suggestions looking to new business by carefully watching this department in the ELECTRICAL REVIEW from week to week:

New Electric Railways.

READING, PA.—Mayor Merritt has signed a bill granting to the City Passenger Railway Company the privilege of using the trolley system on all the company's lines, which cover some 30 miles of street.

PLATTSBURG, N. Y.—J. T. Eustace and D. J. Neagle, of Elmira, have been investigating the proposition to construct an electric street railway.

WORCESTER, MASS.—The newly formed State Central Street Railway Company, which is to build 43 miles of electric railway, radiating from Worcester, formally organized by electing Samuel Winslow president, and Thos. T. Robinson, clerk and treasurer.

DUNDEE, ILL.—The Dundee Rapid Transit Company has been incorporated with a capital of $50,000 by Edgar C. Hawley, Wm. Ray and G. F. Oatman.

BRAZIL, IND.—R. N. Bails, president of the Springfield and Rockford, Ill., street car line, is arranging to construct an electric street railway in Brazil. The city council has granted the company a 50-year franchise of the principal streets. The plant will cost about $50,000.

CORNING, N. Y.—The Citizens' Electric Street Railway Company will soon ask the common council for a franchise to build a street railway through Corning.

ST. LOUIS, MO.—The Southern Electric Railroad Company; capital, $1,000,000. Incorporators, Thos. L. Johnson, of Cleveland, O.; J. C. Richardson and Edward S. Lovejoy. The above company is a reorganization of the Southern Railroad Company.

WEBB CITY, MO.—The power house for the Electric Street Railway Company will be located near the Union Depot in this city. Work will commence as soon as the plans and specifications are completed.

BUFFALO, N. Y.—D. W. Allen, of Buffalo, heads a syndicate that proposes to build an electric railway to West Seneca.

DAYTON, O.—A new electric street railway is now being discussed. Judge Dwyer and Hon. O. B. Brown are back of the project.

BOWLING GREEN, O.—E. H. McKnight, of Bowling Green, and other capitalists, will build an electric railway between Troy and Piqua. They have given a bond that they will complete the road by August.

KEARSARGE, N. H.—A bill to incorporate the Kearsarge Electric Street Railway has been introduced in the house at Concord.

COLUMBIA, PA.—The Columbia and Donegal Electric Railway Company will build a 250 horse-power electric plant.

FOND DU LAC, WIS.—The Fond du Lac Light, Power and Railway Company has been incorporated with a capital of $100,000. The directors are H. A. Odell, E. R. Gilman, Chicago; R. S. Munger, O. H. Simmons, Duluth; W. G. Decelle and H. S. Cole, St. Paul.

HARTFORD, CONN.—The incorporators of the proposed Hartford, Manchester and Rockville Tramway Company include N. T. Pulsifer and M. S. Chapman, of Manchester; Adams Claflin, of Boston, Mass.; C. E. Hilliard, of Manchester and E. S. Henry, of Rockville. Electricity will be employed as motive power.

NEW ROCHELLE, N. Y.—The attempt to substitute the trolley system for horse-power on the street cars has been indefinitely postponed. The citizens were opposed to it and would not give their consent. The citizens do not object to the storage battery if one is found to be practicable, but they are against the trolley.

PHILADELPHIA, PA.—A new traction company will be formed for the purpose of purchasing all the street car lines of this city not under the control of the Philadelphia Traction Company. The new company will be capitalized for $10,000,000, and will extend the lines both within the city and in the suburbs. The trolley system will be introduced and it will be the very best.

DENVER, COLO.—The Arapahoe Railway Company; capital, $25,000. Incorporators, C. H. Sage, Wm. R. Harp, Wm. A. Cooper and Matthew P. Cochrane. The company proposes to build and operate electric railway systems to the suburban towns contiguous to Denver.

PHILADELPHIA, PA.—Holmesburg and Bristol Street Railway Company has been incorporated, with a capital stock of $60,000 This company will operate 10 miles of road between Philadelphia and Torresdale.

BRIDGEPORT, PA.—Montgomery County Passenger Railway Company; capital, $50,000. Promoters, Cornelius Gallagher and Edw. S. Perot.

PHILADELPHIA, PA.—Philadelphia and Delaware Street Railway Company, with a capital stock of $150,000, has been organized by Jos. H. Hinkson and G. P. Demus, of Chester, Pa.

DRIFTON, PA.—The Union Street Railway Company has been organized by H. E. Sweny and F. W. Bleckley.

PHILADELPHIA, PA.—The Inter-State Traction Company. Incorporators, P. McManus, Jas. B. Reilly, Irvin T. Riter, C. Eakin Jones, Eli H. Chandler, Alexander Simis and H. L. Chandler. Principal office, 207 Walnut Place. Incorporated to buy, lease, operate and maintain street railways, electric light and power plants in Pennsylvania and other States.

EVERETT, WASH.—A company has been formed to build an electric railway from Everett to Snohomish, eight miles. The incorporators are M. Swartout, R. M. Mitchell and J. E. McMannus.

CANTON, O.—The Canton and Massillon Electric Railway Company is about to build lines to Louisville, Navarre, New Berlin and Osnaburg, and representatives of the company are soliciting for right of way.

LINCOLN, NEB.—A new electric company will be formed and an electric plant will be built in connection with the street railway. E. Finney and J. H McMurty are interested.

BURLINGTON, VT.—A syndicate has purchased the Winooski and Burlington Horse Railroad. The road will be equipped with the trolley system in the spring.

CONSHOHOCKEN, PA.—The Conshohocken Railway Company; capital, $100,000; to be 7½ miles long, and run from Norristown through Conshohocken to Spring Mill. Directors, James W. Shepp, D. B. Shepp, Philadelphia; Geo. W. Wood and John Pugh, Conshohocken.

BRISTOL, PA.—The Bristol and Trenton Passenger Railway Company; capital, $48,000; to run from Bristol to Morrisville, eight miles. Directors, Edward Morrell, Wm. V. Massey and Adolph Hermann, of Torresdale, and F. J. Edwards, of Bristol.

PHILADELPHIA, PA.—The Radnor, Haverford and Philadelphia Passenger Railway Company; capital, $75,000; to run from Philadelphia to the suburbs. Directors, George Young, Peter J. Hughes, Wm. L. Kite and Frank S. Harrison.

LEWISTON, ME.—An electric railroad to extend from Lewiston to North Conway is one of the latest projects.

OLEAN, N. Y.—A majority of the property holders on the line of the proposed electric road between Olean and Allegany have signed the right of way.

PETERSBURG, ILL.—The Petersburg electric light plant is to be enlarged.

DEVIL'S LAKE, N. DAK.—A company with $50,000 capital has been organized to put in an electric light plant and street railway.

OLYPHANT, PA.—The Olyphant Suburban Traction Company, to run from Dunmore to Olyphant; capital, $36,000.

DALLAS, TEX.—The mayor has signed an ordinance granting valuable franchises to A. W. Childress and associates to construct and operate an electric railway. About 15 miles of track will be built before July 1.

ST. LOUIS, MO.—It is understood that a scheme is being considered by the Carondelet Light and Power Company, for running an electric road to the suburbs.

MOBILE, ALA.—The Mobile Street Railway Company has petitioned the council for an extension of the time allowed in which to begin changing the motive power to electricity.

FORT WAYNE, IND.—A stock company is being organized for the purpose of connecting New Haven and Fort Wayne by an electric railroad.

HOBOKEN, N. J.—An electric mail route between this city and the North Hudson towns is projected by the North Hudson Railway Company, which will also establish a new trolley line to Jersey City.

SPRINGFIELD, O.—It is reported that O. S. Kelley, of Springfield, has sold his patent on the overhead electric trolley system to the General Electric Company for a sum running into the hundreds of thousands. Whew!

EXETER, N. H.—A charter has been granted for an electric road between Exeter and Hampton Beach. The control of the road will be given into the hands of the Concord and Montreal Railroad Company.

GREENPORT, N. Y.—The feasibility of building an electric railway between Greenport and Orient is being discussed among some of the stockholders of the Greenport Electric Light and Power Company.

Electric Light and Power.

BOUND BROOK, N. J.—The Bound Brook Electric Light, Heat and Power Company; capital, $5,000. Incorporators, Charles P. Seabring, of Plainfield; F. H. Cook, of Bound Brook, and Louis J. Auerbacker, of Newark.

CAMERON, TEX.—The city will erect an electric light plant.

YORK, ME.—The New York Electric Light and Power Company; capital, $100,000, has been organized for the purpose of erecting an electric plant.

CAMDEN, N. J.—The Commonwealth Electric Company; capital, $100,000. Incorporators, Louis B. Henry, of Eddington, Pa.; Oliver E. Maltley, of Philadelphia, and Chas. W. Weygand, of Camden. The company will manufacture and sell dynamos, motors, lamps and electrical apparatus.

REDWOOD CITY, CAL.—Frederick W. Swanton, of Santa Cruz, will establish an electric light plant at Redwood city.

WELLSVILLE, N. Y.—The franchise for an electric light plant granted to J. G. Kaelber has been transferred to the Wellsville Electric Light, Heat and Power Company, composed of J. G. Kaelber, president; M. O'Connor, Jr., secretary; C. D. Crandall, treasurer; John McPherson and John Kaelber, directors.

LEWISTON, IDAHO.—A joint stock company has been formed to purchase the franchise of the Lewiston Electric Light Company.

KISSIMMEE, FLA.—An electric light plant for Kissimmee is projected. The plant is promised if the right of way can be secured.

CANANDAIGUA, N. Y.—M. D. Munger, president of the Canandaigua Electric Light Company, has purchased mill dam rights at Littleville, and will at once complete arrangements for constructing an electric light station at that place, to re-enforce the local plant.

New Manufacturing Companies.

BRIDGEPORT, CONN.—A new industry is to be established here by a corporation formed to introduce in this State the Pennock system of electricity. It will be organized as the Pennock Battery, Electric Light and Improvement Company.

CHICAGO, ILL.—The Calumet Electric Manufacturing and Engineering Company; capital, $10,000. Incorporators, E. M. Ashcraft, L. H. Hine and Geo. E. Dorman.

SAN FRANCISCO, CAL.—The San Francisco Electric Company, capital, $100,000, has been incorporated by J. G. Gardner, C. S. Wright, J. F. Myers and H. E. Monroe.

PORT HURON, MICH.—The Electric Supply Company, of Port Huron has been incorporated with a capital stock of $5,000.

AUBURN, ME.—The Auburn Electric Motor Company has been organized for the purpose of building motors, dynamos and other electrical machinery.

Telephone and Telegraph Companies.

ST. JOSEPH, MO.—After March 7, the city of St. Joseph will declare itself independent of the Bell Telephone Company, and will have a system of its own, solely under municipal control.

SPARTANBURG, S. C.—The Glenn Springs Telephone and Telegraph Company has been incorporated to build a telephone line from Spartanburg to Glenn Springs. President, Paul Simpson; secretary and treasurer, R. C. Simpson.

FREEPORT, CAL.—The Freeport Telegraph and Telephone Company; capital, $40,000. Incorporators, D. T. Lufkins, H. T. Lufkins, George Lawler, H. T. Huggins and J. G. Hite.

MCKEESPORT, PA.—The McKeesport Telephone Company has been incorporated, with a capital of $50,000.

CHICAGO, ILL.—The Independent Telegraph Company; capital, $25,000. Incorporators, O. M. Stone, J. W. Turner and George H. Stone.

Queen's Portable Photometer.

Queen & Company, incorporated, Philadelphia, report a steady demand for their portable photometers, which instrument accurately measures the candle-power of incandescent lamps, and can be used wherever desired. It is very important from an economical standpoint for a central station manager to use lamps that give the greatest illumination for energy consumed, and this convenient apparatus enables comparisons of different types to be quickly made. When a customer complains of poor light an impartial test will settle the dispute much more quickly than words, and there is no appeal. The makers issue descriptive circular No. 295, which gives further particulars. Interested parties should ask them for a copy.

KINDRED INTERESTS

The Edson Recording Gauge continues to be in demand in all progressive electric light and power stations. It is one of the essentials that often saves enough to pay the dividend.

The Walworth Manufacturing Company, of Boston, manufactures one of the most substantial and popular poles for electric railways, and is doing a very large business. This company also deals in general electric railway supplies, and makes a specialty of line construction. It is one of the large houses of Boston and thoroughly reliable.

The Berlin Iron Bridge Company, of East Berlin, Conn., will build the new machine shop for S. F. Hodge & Company, Detroit, Mich. The building will be 150 feet long and of the modern type, the central portion being 40 feet in width, controlled by a traveling crane of 20 tons capacity, with a wing on each side 22 feet in width, the wings being two stories high. When completed it will be one of the best machine shops in the Northwest.

A New Electric Light Plant in Logansport, Ind.

The Logansport Electric Light and Power Company started yesterday their new 150 horse-power Ball engine, made by the Ball Engine Company, Erie, Pa., and their new 1,300 light compound wound alternator, made by the Fort Wayne Electric Company, Fort Wayne, Ind.

The Ball engine is now considered the best engine made, being equipped with their very latest improved governor and other devices, which will have a tendency to make the engine very economical. The engine and alternator made a run last night of 16 hours with perfect satisfaction in every particular. This new compound wound alternating dynamo is the first of the very latest improved machines made by the Fort Wayne Electric Company, and is self-regulating. Mr. D. M. Seymour, of the Ball Engine Company, Messrs. J. J. Muir and Driftneyer, steam expert and electrician of the Fort Wayne Electric Company, were present when the engine was indicated. Several cards were taken under various loads, which were very satisfactory, furnishing some very desirable data. Manager Seiter says that more improvements are contemplated.—*Logansport Daily Pharos.*

WANTED AT ONCE.

FIRST CLASS
ARMATURE WINDERS

on arc dynamos. Those accustomed to American or Fort Wayne apparatus preferred. Address, Consolidated Electric Manufacturing Company, 335 Congress Street, Boston, Mass.

NOW READY!

A TREATISE ON
FACTORY MANAGEMENT,

by John Tregoning, M. E., late superintendent Thomson Electric Welding Company. Being a comprehensive scheme for the better management of Factories. Price, 40 cents, post-paid, no stamps. Address, **Author, Box 79, ATTLEBORO, MASS.**

FOR SALE.

Two 60 H. P. and one 50 H. P.
ARMINGTON-SIMS HIGH SPEED ENGINES.
Are second-hand, but in first-class condition.

Purchaser can inspect them in actual service. Address,
The Bridgeport Electric Light Co., Bridgeport, Conn.

WANTED.

A MANAGER of an electric light plant, whose duties will be to keep books, superintend the plant and collect the monthly rents. Correspondence solicited, stating references and salary wanted. A young man preferred. Address,
M. L. OPPENHEIMER,
Eagle Pass, Tex.

WANTED TO **BUY**
INCANDESCENT & ARC
DYNAMOS, ENGINES, BOILERS, WIRE, Etc.
Either new or in good condition
for an electric plant in town of 15,000 inhabitants. Would buy a plant complete if it could be moved. Address, Frank P. Arbuckle, Highlands, Denver, Col.

FREMONT WILSON,
ELECTRICIAN,
Plans and Specifications for Interior Lighting Prepared, and Personal Supervision Given to all Work. Appraiser of fire losses on electrical apparatus.
INSURANCE SURVEYS A SPECIALTY.
Room 153, Times Building, - - NEW YORK CITY.

HOMER SHOEMAKER,
Attorney and Counsellor-at-Law,
HARRISBURG, PA
Special attention given to matters affected by the corporation laws of Pennsylvania.

The Chicago, Milwaukee & St. Paul Ry.
HAS
Electric Lighted and Steam Heated Vestibuled Trains, with Westinghouse Air Signals, between Chicago, Milwaukee, St. Paul and Minneapolis, daily.
Through Parlor Cars on day trains between Chicago, St. Paul and Minneapolis.
Electric Lighted and Steam Heated Vestibuled Trains between Chicago and Omaha and Sioux City, daily.
Through Vestibuled Sleeping Cars, daily, between Chicago, St. Paul, Butte, Tacoma, Seattle and Portland, Ore.
Through Vestibuled Sleeping Cars, daily, between Chicago and Denver, Col., *via* Omaha and Lincoln.
Solid Trains between Chicago and principal points in Northern Wisconsin and the Peninsula of Michigan.
Daily Trains between St. Paul, Minneapolis, and Kansas City, *via* the Hedrick Route.
Through Sleeping Cars, daily, between St. Louis, St. Paul and Minneapolis.
The finest dining cars in the World.
The best Sleeping Cars. Electric Reading Lamps in Berths.
6,100 miles of road in Illinois, Wisconsin, Northern Michigan, Iowa, Minnesota, Missouri, South Dakota and North Dakota.
Everything First-Class.
First-Class People patronize First-Class Lines.
Ticket Agents everywhere sell Tickets over the Chicago, Milwaukee & St. Paul Railway, or address GEO. H. HEAFFORD, General Passenger Agent, Chicago, Illinois.

Established 1847. Purely Mutual.
INSURE IN
The PENN LIFE Company,
— OF —
PHILADELPHIA, PA.
WHY?
IT IS THE BEST!
Assets, - - $18,551,388.30
Surplus, - - 2,465,689.13
Apply for Rates to
EZRA DE FOREST, Gen'l Agent,
13 Park Row, New York.

MACHINERY IN STOCK.

Engine Lathes, 10 in. x 4 ft.; 11 in. x 5 ft.; 12 in. x 6 ft.; 14 in. x 6 ft.; 16 in. x 6 ft.; 18 in. x 8 ft.; 20 in. x 8 ft., with tapes attachment; 22 in. x 12 ft. and 14 ft.; 24 in. and 26 in. x 16 ft.; 30 in. x 10 ft. and 18 ft.; 36 in. and 38 in. x 20 ft.; 42 in. x 12 ft.; 27 in. x 32 ft.; 88 in. x 31 ft.; 96 in. x 20 ft. Fox Lathes, 13 in. x 5 ft.; 14 in. x 5 ft.; 14 in. x 5 ft.; 15 in. and 16 in. x 6 ft.; 18 in. x 6 ft.; 36 in. x 8 ft.
Planers, 16 in. x 16 in. x 3 ft.; 20 in. x 20 in. x 4 ft.; 24 in. x 24 in. x 6 ft.; 30 in. x 30 in. x 6 ft.; 36 in. x 36 in. x 10 ft.; 42 in. x 42 in. x 12 ft.; 44 in. x 48 in. x 22 ft.; 60 in. x 49 in. x 24 ft.
Friction Shapers, 15 in., 16 in., 20 in., 22 in., 32 in.
Crank Shapers, 6 in., 8 in., 10 in., 12 in., 13 in., 16 in., 17 in., 20 in., 24 in., 28 in.
Screw Machines, Nos. 1, 2, 3, 4, with or without Wire Feed.
Screw Machines, Nos. 5, 6, 7, 8, Power Feed.
Presses, Nos. 51, 52, 53, Ferracute; Nos. 1, 2, 3, Stiles & Parker.
5 Lincoln Pattern Millers, No. 2.
Hand Millers, Nos. 1 and 2. 3 Cam Cutters.
Bolt Cutters, ¼ in. to 1 in., ½ in to 2 in.
2 Profiling Machines. 1 36 in. and 48 in. Gear Cutter.
C. D. and E. Horizontal Boring Machine. Newark Machine Tool Co.
Send for List of New and Second-Hand Machinery in Stock.
PRENTISS TOOL & SUPPLY CO., P. O. Box 3362, 115 Liberty Street, New York. 59 South Canal St., Chicago, Ill.

ELECTRICAL MEASUREMENT
Instruments and Batteries of the Very Highest Grade.
Precision and Constancy, Quality and Finish the Best in the World.
Catalogue of Standard Test Instruments furnished upon application.
THE E. S. GREELEY & CO.,
5 AND 7 DEY ST., NEW YORK.

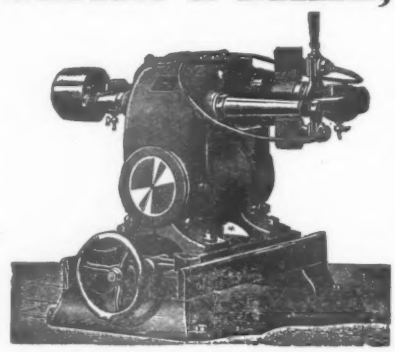
RAILS
IRON OR STEEL, CHEAP.
We own and offer for sale, cheap, 100 tons of selected, second-hand, 30 lb. **IRON RAILS,** in Chester Co., Pa., all in good condition; also 400 tons of second hand 52 lb. **STEEL RAILS,** at Pittsburgh, Pa., in excellent condition. We sell **NEW STEEL RAILS** at lowest prices.
Write or wire us:
ROBINSON & ORR,
419 Wood St., PITTSBURGH, PA.

ENGINE CASTINGS

from one-eighth to six horse power Horizontal & Marine.
8, 16 & 60 LIGHT DYNAMO CASTINGS.
Simple Sewing Machine and Fan Motor Castings with instructions for building complete machines.
Send Stamp for Catalogue.
PALMER BROS., Electrical Supplies, Mianus, Conn.

HOW TO MAKE A ONE HORSE-POWER MOTOR OR DYNAMO,
By A. E. Watson.
Complete directions for building a practical high speed machine; 50 pages; illustrated; price, 25 cents. ELECTRICAL REVIEW PUBLISHING CO., 13 Park Row, New York.

SWAN & LANE,



ELECTRICAL CONTRACTORS,
193 Summer Street, Boston, Mass.
Agents for Apparatus of the
Jenney Electric Motor Company.
Specifications and Estimates furnished for the
Installation of Electric Light and Power Plants.
WIRING OF ALL KINDS.
Theatrical Electric Supplies.
SWAN'S CURRENT INDICATOR.
Dynamos for Light and Power. Motors for all Industries requiring Power.
Power Generators for Power Circuits.
Telephone 3495.

Daniel W. Baker. Cyrus O. Baker, Jr.
BAKER & CO.,
Importers, Melters and Refiners of
PLATINUM,
408, 410, 412 and 414 N. J. R. R. Ave., NEWARK, N. J.
Platinum in sheet and wire, all sizes, and any degree of hardness. Scrap and native platinum purchased.

The Oldest and Largest Manufacturers in the World of
HARD RUBBER.
MOLDED WORK A SPECIALTY.
The Goodyear Hard Rubber Co. The India Rubber Comb Co.
Established 1851. EVERY DESCRIPTION OF ARTICLES MADE TO ORDER.
Office and Salesrooms, 9, 11 and 13 MERCER STREET, NEW YORK.

NO CENTRAL STATION
Is Complete without our
PORTABLE STANDARD TESTING RESISTANCE SET.
It can be used under every condition of practical work, and is the only instrument of its class unaffected by magnetic fields or mechanical jars.
Ask for Descriptive Circular No. 285.
— Manufactured by —
QUEEN & CO., INCORPORATED,
PHILADELPHIA.